



PRINCIPAL CONTENTS



Lucerne Top-Dressing Tests
The World's Poultry Congress
Foot-Rot of Sheep
Potato Manure Trials, 1929-30
Longerenong Agricultural College
Experimental Work
Prune Drying
Kardella Calf Club

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OF

THE DEPARTMENT OF AGRICULTURE

VICTORIA, AUSTRALIA.

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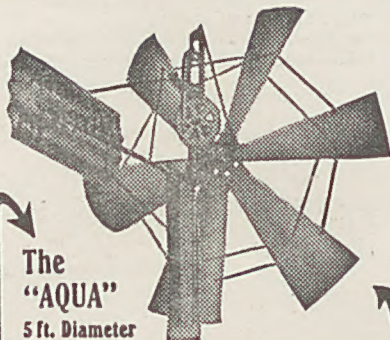
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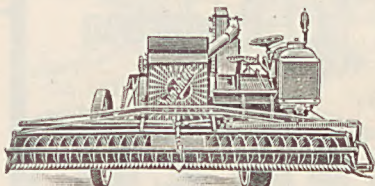
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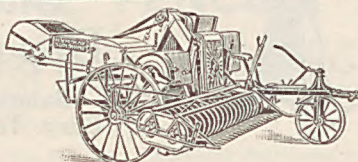
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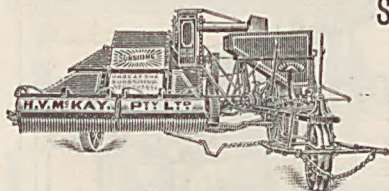


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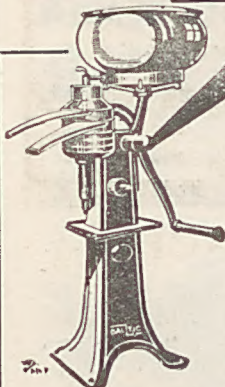
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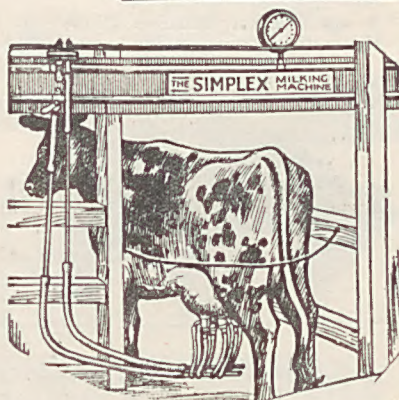
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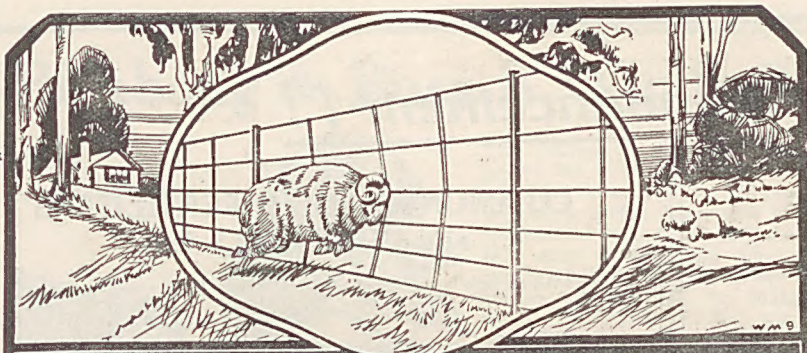
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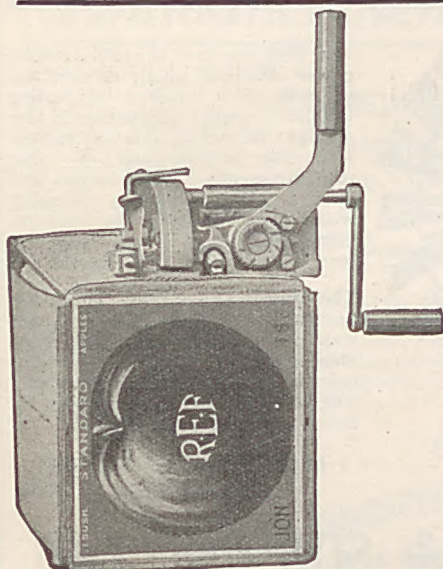
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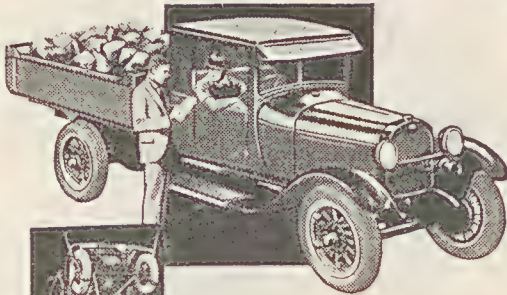
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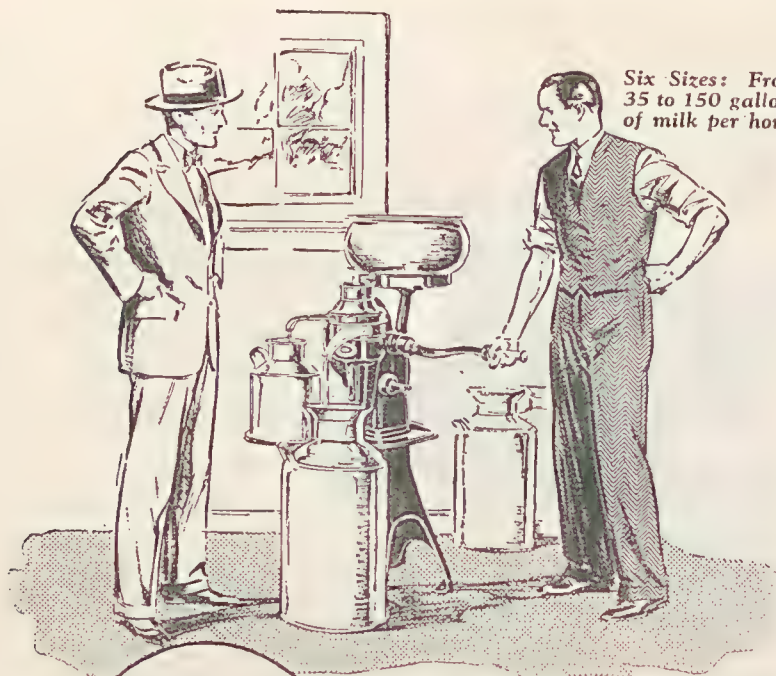
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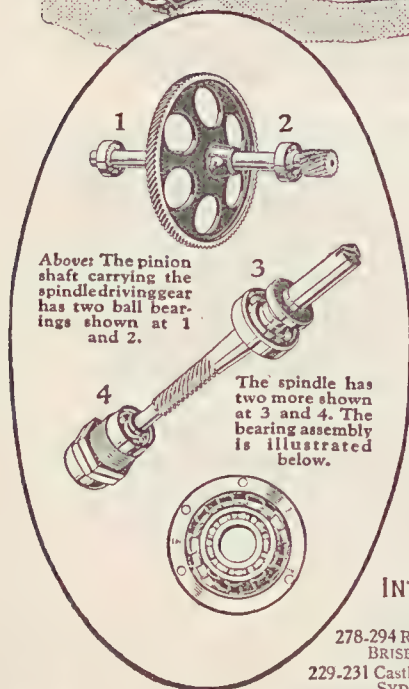
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Vol. XXVIII.

November, 1930.

Part 11

LUCERNE TOP-DRESSING TESTS.

RESULTS AT TONGALA AND COHUNA.

By L. C. Bartels, B.Ag.Sc., Senior Irrigation Officer.

Experimental plots to investigate the effects of top-dressing lucerne with superphosphate were established at Tongala in 1925 and at Cohuna in 1926. In addition, other plots, which have since been discontinued, were laid down at Swan Hill and Rochester in 1924 and at Stanhope in 1925. These were all established under the auspices of the Irrigation Investigations Committee to determine the applicability of the lessons learned from the experiments at the Werribee Research Farm to the conditions on other irrigation settlements of the State. These Werribee tests have been carried on since the establishment of the farm in 1913, and the present series of tests at the Research Farm, laid down in 1925, includes 47 plots. The successive experiments at Werribee have all shown the necessity for top-dressing, the value of phosphatic manures, the superiority of superphosphate over less soluble manures, and a limited usefulness of gypsum. The results have been carefully measured as hay yields (15 per cent. moisture content) and five cuts have been made regularly each season in all centres.

The results from all the test plots point in the same direction. Those from the plots in the northern irrigation districts support the Werribee findings, but they have eclipsed those obtained at Werribee. The plots at Swan Hill on the Murraydale flats, which were conducted from 1924 to 1929, showed increases in production, due to superphosphate, up to 200 per cent., and yields of hay up to 8 tons per acre were maintained on the heavily-manured plots. When the experiment was terminated, the stand of lucerne was ten years old; but the manured lucerne showed a density and vigour of growth as good as a three-year-old stand.

The results presented at Tongala on the farm of Mr. J. Bullingham have been scarcely less marked, and they have a much wider application. The Rochester and Stanhope results, which were on somewhat

similar soil, confirmed those obtained at Tongala. The tests at Cohuna have directed attention to the value of superphosphate there.

In the six years since these tests were commenced, top-dressing has become an established practice throughout the irrigation districts. It is not too much to say that the prospects of the settlers have been brightened as a result, because the widespread use of superphosphate has set in train other improvements. The development of irrigated grasses and clovers cannot be dissociated from the extended use of superphosphate, and because these pastures demand regular watering, there has been a decided advance in irrigation methods. Arrested soil exhaustion and increased productivity are noted everywhere; more feed and better feed enable farmers to make ample reserves, and are directly the outcome of manuring. Healthier stock have resulted, and reduced mortality in flocks and herds has been recorded.

The fear sometimes expressed that the use of superphosphate will exhaust the cropping capacity of the land after a few years is not warranted. It obtains no support from the tests under review. At Tongala, for example, it would be difficult to forecast the limits of the useful life of the manured lucerne, but the unmanured stand does not make very vigorous growth. It has to compete with weeds, and compared with the manured lucerne, it makes an unattractive picture.

It will be apparent, from the results shown hereunder, that the several advantages accruing from the use of superphosphate far outweigh its cost. The manure has been applied in August of each year.

TONGALA RESULTS, 1925-1930.

Plots on Farm of Mr. J. Bullingham.

Record of Yields of Hay (15 per cent. moisture) in cwt. per Acre.

Plot.	Yield in Cwts. per Acre.					Average Five Seasons.
	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.	
1. No manure	84.15	91.6	72.3	73.36	70.7	cwt. 78.4
2. Super. 1 cwt. per acre ..	84.5	98.8	94.3	89.6	97.5	92.45
3. Super. 2 cwt. per acre ..	84.15	101.7	103.1	96.9	114.05	100.0
4. No manure	67.45	76.3	61.8	57.2	55.6	63.7
5. Super. 4 cwt. per acre ..	90.4	115.2	117.8	115.4	128.0	113.5
6. Super. 4 cwt. per acre (two applications) ..	86.65	113.1	114.6	108.85	123.85	109.4
7. No manure	59.2	62.0	53.05	48.1	44.15	53.3
8. Super. 2 cwt., lime 1 ton (1925), gypsum 1 ton (1929)	77.55	99.2	104.35	98.7	103.0	96.6
9. Super. 2 cwt., gypsum 1 ton (1925 and 1929) ..	75.45	94.7	101.3	94.8	103.65	94.0
10. No manure	56.2	60.5	55.6	54.2	45.05	54.3
11. Super. 2 cwt., sulph. of potash 1 cwt. ..	77.85	88.9	101.3	92.3	95.9	91.25
12. Bone fertilizer 2 cwt. ..	60.4	72.6	71.45	68.6	73.8	69.4
13. No manure	55.9	53.95	46.15	40.15	38.05	46.8

COHUNA RESULTS, 1926-1930.

Plots on Farm of Mr. G. Major.

Record of Yields of Hay (15 per cent. moisture) in cwt. per Acre.

Plot.	Yield in Cwt. per Acre.				Average Four Seasons.
	1926-27.	1927-28.	1928-29.	1929-30.	
1. No manure	89.7	44.6	52.6	37.75	cwt. 56.1
2. Super. 1 cwt. per acre	95.1	49.5	60.1	48.2	63.2
3. Super. 2 cwt. per acre	93.4	49.1	62.5	56.9	65.5
4. No manure	86.3	39.1	39.1	30.65	48.8
5. Super. 4 cwt. per acre	105.8	60.1	72.0	66.5	76.1
6. Super. 4 cwt. per acre (two applica- tions)	99.9	57.1	73.3	67.95	74.6
7. No manure	85.2	41.2	45.6	38.25	52.6
8. Super. 2 cwt., lime 1 ton (1926), gypsum 1 ton (1929)	103.2	57.05	68.6	61.2	72.5
9. Super. 2 cwt., gypsum 1 ton (1926 and 1929)	111.1	57.75	71.3	64.95	76.3
10. No manure	107.5	52.05	53.1	44.95	64.4
11. Super. 2 cwt., sulph. of potash 1 cwt.	107.0	56.55	71.9	69.45	76.2
12. Bone fertilizer 2 cwt.	96.9	47.45	55.1	48.1	61.9
13. No manure	88.6	45.4	46.3	41.6	55.5

CULTIVATION TESTS.

Yields of Hay (15 per cent. moisture).

Plot.	1927-28.		1928-29.		1929-30.		Average.
	Cwt.		Cwt.		Cwt.		
1. Not cultivated ..	52.4	..	55.1	..	57.15	..	54.9
2. Cultivated ..	48.2	..	57.5	..	55.4	..	53.7
3. Not cultivated ..	49.9	..	54.1	..	59.45	..	54.5
4. Cultivated ..	44.7	..	53.1	..	58.8	..	52.2

It was noticed during the season that Umbrella Grass was more in evidence on the uncultivated plots; but on the 4-cwt. superphosphate plots in the manurial series, there was a reduction of this grass as compared with other plots.

Although the cultivation tests conducted have been confined to Werribee and Cohuna, it has not been possible to demonstrate in any case that cultivation increases the yield of lucerne.



THE WORLD'S POULTRY CONGRESS.

AN IMMENSE GATHERING.

By W. C. Rugg, Chief Poultry Expert.

The World's Fourth Poultry Congress was held between the 22nd and the 30th July, at the Crystal Palace, London, and was formally opened by His Royal Highness the Duke of York.

Probably no other building in London would have been big enough to house the immense exhibition of birds; indeed, even the Crystal Palace was not sufficiently large, and the English and Irish birds had to be shown in a marquee in the Palace grounds. Some idea of the size of the Crystal Palace can be gathered from the fact that it has a floor space of nearly 25 acres. For nearly three-quarters of a mile the visitor may walk under a noble roof of glass. It may be of interest to readers to know that the area of floor space at the Crystal Palace is 25 acres—approximately twelve times larger than the total floor space of the Melbourne Exhibition Building, which is the largest building of its kind in the Commonwealth. The grounds of the Crystal Palace are 200 acres in extent, and are laid out in landscape gardens suitable to the soil and situation. The area of our Exhibition Gardens is approximately 40 acres.

The Congress was a great success, and it equalled, if it did not surpass, any of the three previous Congresses—the first of which was organized in Holland in 1921, the second in Spain in 1924, and the third in Canada in 1927.

The total number of delegates to and members of the last Congress was 2,400, of whom approximately 1,100 came from overseas countries. From the dome of Crystal Palace there were suspended the flags of the 60 nations represented. Visitors formed a cosmopolitan assemblage, and the number of languages in which addresses were given from time to time was about twelve. The total number of visitors to the Congress was in the region of 80,000.

The Duke of York, in opening the Congress, said, "It is a happy occasion which has brought together the representatives of 60 countries to discuss the further development of an industry of such great economic importance. During the present depression from which agriculture is suffering all over the world, we are glad to know that the Poultry Industry has brought a measure of relief to many farmers.

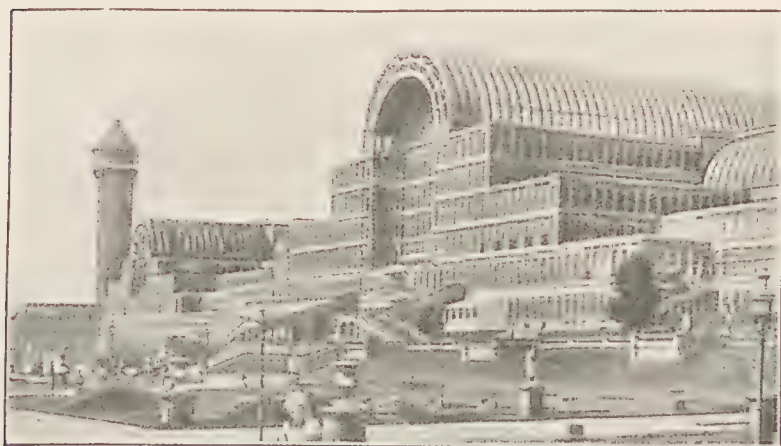
"In an Exhibition so vast as this it is hard to single out any one item for special mention, but I would draw your attention to the fact that under this roof you will find the first and latest developments of the industry.

"First of all comes the Indian Jungle fowl, without which poultry would never have been, and within a few yards of them you will see the most modern breeds of poultry, together with appliances not dreamed of even a few years ago, such things as mammoth incubators, electrical brooders and incubators for no less than 3 tons of eggs.

"We are fortunate in having gained the support and assistance of so many other countries in organizing this gathering. We appreciate their help, and I should like to congratulate them most warmly upon the part they have played in presenting this wonderful display.

"Competition between nations in the world of commerce may exist, but, if international trade is to be successfully carried on, there must be mutual trust and goodwill. Let us therefore strive to develop these most essential conditions and so increase mutual understanding that this Congress may confer the fullest possible benefit upon all those taking part."

The British Minister of Agriculture, Dr. Addisson, Mr. F. C. Elford, on behalf of Canada, and Professor Salvado Castello, on behalf of Spain, thanked His Royal Highness for his attendance.



General View of Crystal Palace.

The Exhibits.

The exhibition was staged in three sections—No. 1, National exhibits; No. 2, Live-stock exhibits; and No. 3, Commercial exhibits.

The National exhibits were situated in the north nave. In these, participating countries staged exhibits to illustrate the part played by education, research, and economies in the development of the poultry industry.

The Live-stock exhibits were displayed on the ground floor and the galleries of the main floor. They included practically every known breed of fowls, ducks, geese, turkeys, pigeons, and rabbits, and numbered over 7,000. A last-minute exhibit arrived by aeroplane after a 1,000-mile flight from Austria.

The Commercial exhibits were shown in the south nave. Included in these was a very wide range of electric incubators, brooders, houses, and poultry appliances of every description used by poultry breeders in almost every part of the world.

A very fine model of the Prince of Wales' ranch was included in the Canadian section—a section that occupied altogether over 45,000 square feet of floor space.

It was generally admitted by Australian visitors that the display by the Empire Marketing Board was probably the most instructive and interesting in the exhibition. It indicated that between 1913 and 1928 the national output of eggs nearly doubled, and this increased production represents an addition of £7,000,000 to the national income.

There were 156 papers read at the Congress, by the delegates from the different countries, under the following sections:—

	Papers.
Breeding and incubation	29
Nutrition and rearing	25
Diseases and their control	32
Economics, including marketing	30
Education and general	31
Rabbits	9
	156

The Marking of Cool Store Eggs Discussed.

A proposal was made at the Congress that a recommendation be made that all eggs which had been in storage should be branded "cold stored." Australian and South African eggs, which are necessarily exported under refrigeration, but which, owing to their high quality and to rigid inspection before shipment, can be landed on the London market in a condition equal, if not superior, to those from any country in the world. Experienced men have stated that it is difficult to tell an egg imported from Australia from a new-laid English egg.

According to the English poultry press a long discussion took place on the proposal, and delegates from Sweden, Denmark, Holland, and Italy spoke in favour of it.

A vigorous protest was made by Mr. J. J. Jordaan, the delegate from South Africa, and he was strongly supported by the delegates from other Dominions.

Finally Professor Ghigi, of Italy, moved a resolution "That the International Institute of Rome be asked to convene a conference to endeavour to agree upon an international mark for cold-storage eggs in all countries of the world." This was carried by a large majority. It is not likely that anything further will be done in the matter until the Fifth World's Poultry Congress meets in Rome in 1933.

There is little doubt that had it not been for the strong protest made by South Africa, and supported by the other Dominions, our export eggs would have been placed at a disadvantage as compared with those from European countries from which, owing to their being only a few hours' or, at the most, a couple of days' journey from Great

Britain, eggs can be shipped as ordinary cargo. It is to be hoped that efforts will be made to safeguard the Australian egg export when this matter again comes up for discussion.

A Victorian Exhibit.

When the Ministry of Agriculture in England was notified by the Commonwealth Government that it had decided not to send a delegate, invitations were sent to all the States to send delegates or exhibits. Under instructions from the Minister and Director an exhibit of enlarged photographs and graphs was sent from Victoria, which was the only Australian State that was represented by an exhibit.

The exhibit consisted of three sections—(1) the Poultry Section of the Research Farm, Werribee; (2) the Burnley Egg-laying Competition; and (3) Commercial Poultry Farming in Victoria.

The Research Farm section consisted of a very fine aerial photograph of the farm surrounded by photographs of all the buildings used for breeding poultry and for carrying out experimental work, also a set of photographs of pedigree-bred birds, both males and females, of the breeds kept.

In the Burnley section an enlarged picture of the competition pens was shown, together with photographs of birds that hold records for egg production, and a set of graphs showing results obtained with different breeds since the competition was inaugurated in 1911, also the improvement in the weight of eggs since 1925.

The Commercial section included an aerial photograph of the largest poultry farm in the Commonwealth, that of Messrs. Carter Bros., at Werribee, where an average of 50,000 laying hens is kept. Surrounding this were displayed views of every branch of poultry-farming carried on in Victoria, including turkey, goose, duck, and squab breeding, also pictures of grading and packing eggs and poultry for export, and a graph showing variations in prices of eggs since 1907.

The whole exhibit occupied a wall space of about 400 square feet, and by the kindness of the Empire Marketing Board, was displayed in the area allotted to the Board. Mr. F. White, Trade Commissioner of the Agent-General's office, had the photographs placed in black frames, and they showed up well against a light-buff background. A large sign, "State of Victoria, Australia," in gold letters, was hung in front of the exhibit.

Under instructions from the Director an illustrated pamphlet was prepared giving particulars of the Poultry Industry of Victoria, and some thousands of these were distributed to visitors at the exhibit.

Although the Congress concluded on 30th July, the Empire Marketing Board requested Mr. White to allow the exhibit to remain until after the August bank holiday, as large crowds were expected to visit the Crystal Palace on that date.

Since the Congress closed several applications have been received in Melbourne for further information regarding the export of eggs, poultry, &c. This is an indication that the sending of an exhibit to the Congress has been of some service to the State.

THE KARDELLA CALF CLUB.

By M. Thomas, Senior Dairy Supervisor.

The Value of Calf Clubs.

Even the most conservative admit there is room for improvement in our stock-breeding and dairying methods, but in the normal course changes come slowly, and it will be for the children of to-day, when they become the men of to-morrow, to bring in some of these changes. Recognizing that "as the twig is bent, so the tree is inclined," a move was made some time since by Kardella residents for the formation of a calf club at the local State school, in an endeavour to interest the young people in the rearing and treatment of pure-bred stock. Keen interest has been taken in the movement by the children for its own sake and by parents, for they realize that it will greatly help to increase the children's knowledge of the industry of dairying, in which many of them will later become engaged. Such clubs undoubtedly will do much to make the children efficient in their work, and this will help to solve the problem of keeping the young people on the land, by making farm life brighter and more attractive.

The possession of pure-bred stock is sufficient incentive to the child to become proficient in the rearing and handling of stock, and the more capable and efficient he becomes, the greater will be his value as a unit in the industry in which he is engaged. Experience in other countries has shown that where the children have been started on right lines with pure-bred stock, it is not long before the parents see the folly of keeping old "Brindles" and old "Grannies."

The success of the scheme is dependent upon the co-operation of the teacher and the parents. The parents, in the assistance they render the child, become—as they should be—co-workers in his education. The teacher acts as interpreter of the language of the expert, and leads the child to think in the direction of record-keeping and of feeding and incidental expenses. In many cases parents have, as the result of calf club work, manifested a greater interest in the school and its surroundings, and numerous improvements, both inside and outside the school, have followed. A valuable training in elementary farm economics is afforded those members who endeavour to arrive at the cost of production. The child receiving this practical elementary training in economics will, in later life, be prepared to offer constructive criticism of Municipal and State activities.

The club meetings afford a valuable training in several directions. By discussions, the members acquire facility in speech, the power of exposition, and the ability to take an intelligent part in a discussion.

The continual drift of the youth of the country to the city is causing grave concern to every man who has the prosperity of this country at heart. May not the work of school calf clubs and kindred clubs assist in a small way towards some solution of this problem?

The Beginnings of the Kardella Club.

At a meeting, called by myself for the purpose, the Kardella Calf Club was formed on the 31st October, 1929. At this meeting

officers and an advisory committee were appointed, and it was agreed to make arrangements with a local bank to finance the scheme to the extent of £50 for the purchase of stock. It was also decided that a set of rules should be drawn up and printed. As a result of the increased activities of the club, the advance from the bank has now been increased to £100.

Several pure-bred registered calves—Ayrshire and Jersey—were presented to the club by Messrs. Wadelton, Sandles, and Garry.

Each member of the club was given the care of a calf. In return, each gave a promissory note, due at thirty months from date, for the purchase price of his calf, signed by himself and parent. The value of the calves was fixed on the basis of 8d. per lb. of the dam's annual butterfat. Every member was required to give an undertaking not to sell or dispose of his calf until it was paid for, and the consent of the Advisory Committee had been obtained.



Some of the Competitors.

It would be a great help to the club if other breeders in the district would help by gifts of calves, as it is very difficult to procure the number required to supply one to every member.

Through the kindness of Mr. S. Weisser, of Korumburra, a handsome silver cup was presented to the club for competition amongst the members. The cup must be competed for during three years, the member having the highest number of points for the year to hold the cup for a year, and the member who gains the highest aggregate number of points for the three years to become the owner outright. This competition for the cup created and sustained a keen interest in the club throughout the year. During the recent visit of the Better Farming train to Korumburra, Mr. A. Gill, Senior Herd Tester, Mr. Pederick, Assistant Poultry Expert, and Mr. Courtney, accepted an invitation from the leader to have a chat to the children, and although very tired with a week's constant lecturing on the train, these officers

gave short interesting talks on calf clubs, stock, poultry, &c., which were greatly appreciated by the members.

The Competition.

After the distribution of calves to members, lectures were given by the leader on Saturday afternoons on the feeding and care of the animals.

On the 4th February, 1930, he visited the homes of all the members, and judged their calves, and the work they had done, and awarded points as shown below. Feeding and handling methods were commented on by the leader, and in the case of a couple of animals that were not thriving, he suggested different treatment.

DETAILS OF POINTS AWARDED TO MEMBERS OF KARDELLA CALF CLUB— FEBRUARY, 1930.

Member's Name.	General Confirmation, Health, and Development.	Education, Tending, Handling, Drinking, &c.	Best Complete Record of Cost of Feed and Keep of Calf.	Most Improved Calf.	Total Points.
Possible Points ..	15	15	10	10	50
Richard Hobley ..	15	15	10	10	50
Arthur Pattinson ..	15	15	10	10	50
Keith Carfrae ..	15	13	10	10	48
Beryl Brydon ..	12	10	9	8	39
Isabel Brydon ..	12	10	9	8	39
Marion Aeschlimann..	8	5	9	7	29
Leslie Wynne ..	7	5	7	9	28
Reginald Wynne ..	9	5	6	8	28
Angus Aeschlimann ..	7	5	8	7	27
Jean Dyer ..	10	10	6	8	34

An appeal was made to the Korumburra Agricultural Society by the leader for a separate section on the prize schedule, with first and second prizes for the best-reared calf. This was granted, and Councillor Tal Adkins kindly donated prizes of £1 for first and 10s. for second. At the annual show at Korumburra on the 26th February, all the members of the calf club turned out with their calves, and the sight of the young enthusiasts did one good. The calves were a splendid lot, and did justice to their feeding and the handling bestowed on them by their youthful owners, who looked very important with their brushes and cloths as they put the finishing touches on before judging.

Mr. H. Schwieger, of the Royal Agricultural Society, and Mr. J. T. McGalliard, of the Council of Agriculture, were the judges. Before judging took place, Mr. Schwieger gave the children a very interesting address on the use and value of calf clubs, and of their spread in other countries. Evidence of the opinion of the judges on the way the calves had been reared may be seen in the high marks awarded to each exhibit; in fact, one judge expressed the opinion that he had never seen a better reared calf than the one owned by Master Keith Carfrae, who was awarded the possible 100 points for his exhibit. After the judging, Mr. McGalliard also addressed the children, and congratulated them on the fine exhibition their calves had made.

The following are the points awarded at Korumburra Agricultural Show:—

Name.	Points.
K. Carfrae	100
R. Hobley	98
L. Wynne	95
A. Pattinson	93
I. Brydon	92
R. Wynne	90
A. Aeschlimann	85
J. Dyer	84
M. Aeschlimann	83
B. Brydon	82

On Saturday, 12th April, the annual school picnic was held at Kardella, and a parade of the calves of the club was arranged for that occasion. This caused much interest, as the final judgment had to be



The Winner, Master R. Hobley, with his Cup and Calf.

made for the year. Mr. W. Yuill, Senior Dairy Supervisor of the Department of Agriculture, was the judge. Points were awarded for "Type," "Knowledge," and "Ringeraft," and Mr. Yuill questioned each child very closely. One little girl, Beryl Brydon, gained 19 points out of a possible 20 for the answers under the heading of "Knowledge."

The following are the points awarded each competitor:—

Competitor's Name.	Type.	Knowledge.	Ringeraft.	Total.
R. Hobley	48	16½	25	89½
A. Pattinson	47	16½	26	89½
K. Carfrae	47	17	24	88
I. Brydon	46	18	23	87
B. Brydon	45	19	22	86
A. Aeschlimann	45½	16	23	84½
L. Wynne	46½	15½	22	84
R. Wynne	45	15½	21½	82
M. Aeschlimann	46½	17	28	81½
J. Dyer	Absent			

The highest aggregate points scored in the three judgments were:—

R. Hobley	237½
Keith Carfrae	236
A. Pattinson	232½

Master Hobley thus has won the right to hold the club's silver cup.

After the judging of the calves, another very interesting competition took place—this was a judging competition amongst all the members of the club. Mr. Yuill, with the assistance of Messrs. Cook and Wadelton, two breeders of pure-bred stock, indicated the desirable and undesirable characteristics to be looked for in a cow. Score cards were distributed, and the children were asked to set down the points they thought should be allotted for the parts of the cow, the main features of which had just been pointed out to them.

The result of this judging was astonishing, and some of the visitors expressed the opinion that the children knew more about a cow than they did themselves. First place was awarded to Keith Carfrae, whose card showed a variation of 16½ points from that of the judges; second place went to Angus Aeschlimann, with a variation of 17½ points; and third place to Richard Hobley, with a variation of 18½ points.

An enlarged framed photograph of the calves at the Korumburra Show was presented to the winner, Keith Carfrae, by the leader of the club, as the prize in the judging competition.

At the annual meeting of the club on 26th June, four new members were balloted for, and duly elected. Three of them have been supplied with pure-bred calves, and one member with a pure-bred registered pig of the Large York breed.

Mr. W. M. Lerew, Veterinary Officer of the Department of Agriculture, then gave a most interesting address to the club on "Stock Diseases and how to treat them," which was much appreciated both by old and young.

Hereunder is the record of cost of calf and keep, as kept by Richard Hobley, winner of the silver cup, 1929-30:—

Date.	Debit.		Date.	Credit.	
10.12.29	To Linga Longa Jersey Farm Calf purchased	£ s. d.	26.2.30	By Second prize show	£ s. d.
	Fodder from 10.12.29 to 31.1.30—	10 10 0		Won the Silver Cup for 1930, total points 237½	0 10 0
	40 gal. fresh milk at 8d. per gal. ..	1 6 8			
	70 gal. skim milk at 1d. per gal. ..	0 5 10			
	Fodder from 11.2.30 to 31.3.30—				
	118 gal. skim milk at 1d. per gal. ..	0 9 10			
	20 gal. fresh milk at 8d. per gal. ..	0 13 4			
	Lime and linseed meal	0 4 0			
	1 bushel of bran ..	0 1 11		Debit balance	13 1 7
		13 11 7			13 11 7

In conclusion, I would like to place on record my appreciation of the kindness of the United Pure-bred Societies in accepting, without payment of the usual fee, the membership of the Kardella Calf Club. This generous act on their part has been a great help, and is much appreciated.

ORCHARD IRRIGATION.

THE NEED FOR CAREFUL WATERING.

By F. M. Read, M.Agr.Sc., Horticultural Research Officer.

The irrigator who does not possess a soil auger to use in sampling his soil frequently throughout the year, and certainly before and after each irrigation, is working in the dark. If our irrigationists, from the beginning, had realized the necessity, and taken the trouble to find out what happened to the irrigation water when it percolated away out of sight, it is inconceivable that their errors would have persisted—as they most assuredly have done—unto the second and third generations.

From this it follows that the present generation has a solemn obligation to those who are to come, not only to purchase an auger on each irrigation holding, but to give it extensive use.

In this short article I would like to give you an outline of my own observations with a soil auger, principally on the experimental grove at Treseo, where, for the past five years, irrigation experiments have been carried out.

Length of Run in Irrigation.

In every irrigation settlement I have visited, seepage from irrigation channels has been pointed out to me as the greatest injurious factor. There can be no question that it often is indeed a serious matter, demanding the prompt attention of the authorities concerned; but it should not be allowed to blind us to the fact that, in general, a factor of far greater importance is the excess water applied on the top portions of long irrigation runs.

At Treseo, for example (and I quote Treseo not because the irrigation practised there is in any way inferior to that practised in other settlements, but simply because I know it so well), furrows up to 17 chains in length have been used to my knowledge. At the conclusion of irrigation on the particular block I have in mind, the top few chains were a quagmire, while the trees on the bottom few chains had not received an adequate irrigation. You can imagine the final result.

On Mr. Sloane's grove, which we have used for most of our experiments, this question was investigated. The original length of run was 10 chains, and portion of the grove we irrigated during the first irrigation, just as it had always been irrigated, by four small furrows per row of trees. Here are some of the things we found out.

When sufficient water had been applied to give an application of 6 acre-inches to the whole area—supposing it had been applied uniformly—the water had not reached the bottom trees, and to give a moderate watering of, say, 3 inches to the bottom third of this 10-chain run, it was computed that it was necessary to apply roughly 14 inches to the top third, and 7 inches to the middle third. It will be realized

that, at the conclusion of such an irrigation, the top portion was water-logged and a water-table occurred within 2 to 3 feet of the surface. The middle third was also very wet, and had a water-table within 4 to 5 feet; while the bottom third was comparatively dry, and there was no water-table.

Experiments, which are fully described in this *Journal* for February, 1930, indicate that on these fairly light soils irrigation runs should not exceed 3 to 4 chains in length.

Flood Irrigation versus Furrow.

Flood irrigation has been compared with the usual furrow method at Tresco. Under the furrow system the water sinks into the subsoil without coming in contact, to any great extent, with the surface layers, and under these conditions salt, if it occurs in a soil, tends to accumulate at the surface. It is brought up when the water rises to the surface and is left at the surface when this water evaporates.

Analyses showed that on the experimental grove the concentration of salt in the surface foot of soil prior to the experiment was in the region of 60 to 80 parts of common salt per 100,000 parts of dry soil, and on the furrow irrigated plots it increased as the experiment continued. Of course, in the top few inches it often reached from 500 to 600 parts and even more.

Flood irrigation, on the other hand, tends to wash this salt down from the surface layers, distributing it, as it falls, through many feet of soil. On those portions of the grove where flood irrigation had been practised—and this is now our routine method of irrigation—the salt rarely rises above from 20 to 25 parts per 100,000 in any one foot down to 6 to 8 feet.

Flood irrigation in some form or another has now been widely adopted at Tresco, and it is recommended that, on any land tending to be salty, this method should be adopted, at all events for the first irrigation, and, if possible, for the last of the season. Full details of the experiment referred to appear in this *Journal* for February, 1930.

Even on non-salty soil flood irrigation has much to commend it. For instance, when gypsum is applied to the land it will act very slowly under furrow irrigation, where the rainfall is low. Under judicious watering this action will be much more rapid.

Again, in any soil containing large quantities of limestone—and most of our northern soils do—the disintegrating action of the weather on the surface soil produces considerable amounts of soluble lime, which should, if possible, be washed down into the subsoil as fast as it is formed. Flood irrigation will do this far more efficiently than furrow. Of course, where overhead spray irrigation is possible, it is to be preferred even to flooding.

The Green Crop.

The sowing of a green crop to be ploughed under to add humus to the soil has been an accepted practice from very early times; but few irrigationists have considered the green crop as a drainage proposition

where a water-table occurs near the surface, or where a constant seepage from a channel is thought to occur.

It has always been a feature on the Tresco grove that, as soon as the green crop of peas and beans began to grow in the autumn each year, the water-table began to fall rapidly. Alkali or salty soil frequently possesses very poor drainage properties, and at Tresco we find that drains placed 3 ft. 6 in. deep every two rows of trees, i.e., 48 feet apart, with underlying drains 6 feet deep and 96 feet apart, are unable to keep the soil from water-logging and remaining in this condition for a very long time on those portions where trees are sick, and therefore transpiring little water. When, however, a crop is sown between the trees, the water-table falls:

During the 1928-29 irrigation season, the grove was clean cultivated, and, even despite the drains mentioned, a water-table persisted 3 to 4 feet from the surface.

During 1929-30 a strip of Sudan grass 12 feet wide was sown between the rows; and, for most of the time, the water-table was kept down in the region of 6 feet from the surface. The rainfall and irrigation received in the two years were equal. The sowing of some crop, even a fairly permanent crop, such as lucerne strips, between the rows, on areas subject to a water-table, thus suggests itself, and so long as it is not overdone, and the soil dried out to a degree dangerous to the tree, it can be confidently recommended. The auger here is indispensable; one must know what is going on so that the width of the strip may be varied to increase or decrease the water transpired.

I do not suggest that the use of a green crop in this direction should be, in any way, a substitute for careful irrigation, by which it is generally possible to avoid an excess of soil water; but there are cases where, despite every reasonable care, a water-table will occur. In such cases the transpiration of the crop may be turned to very good effect.

Again, much damage is done to young orchards in the first years. The trees are tiny things with very small root systems. Much of the water applied in irrigation gets down beyond their root zone, and is never available to their immediate neighbourhood. They, therefore, demand more water, although huge quantities may accumulate below them, and lay the foundations for future trouble. In these cases, some crop such as lucerne or maize, or, in fact, anything which can be turned to profitable use, should be used in these early years between the rows in order to remove any excess water applied.

Conclusion.

In conclusion, let me hark back to the soil auger. It may be said that the practical man can tell from the appearance of his trees whether things are going well or not. That is right up to a certain point. If he waits until the trees tell him something is wrong, however, he has waited too long, for in many cases, as we know to our cost, it is then too late to apply the remedy—the long-suffering trees succumb in spite of all his efforts.

FOOT-ROT OF SHEEP.

By R. N. Johnstone, B.V.Sc., Veterinary Officer.

Foot-rot is an infectious disease affecting the feet of sheep and causing lameness. In the early stages the disease is frequently acute; sometimes sheep may apparently recover from the acute condition, but as a rule chronic lameness with deformity of the feet follows. The disease is due to a specific organism or germ, the *necrosis bacillus*, which gains entrance to the tissues of the foot through cracks caused in the sensitive portions by excessive moisture when the flock is grazing on wet pasture, or by mud.

The existence of the disease was recognized in Europe in 1791, and since then it has spread through Great Britain and to most English-speaking countries. It was probably introduced into Australia with some of the earlier shipments of sheep; its spread has been coincident with the increase of flocks, and to-day the disease is to be found in practically every portion of this State, and is most common in those parts where, by reason of heavy rainfall, dense pasture or damp ground, conditions are favorable for its occurrence. The disease is highly contagious, and many instances are known where it made its first appearance in flocks after the introduction of a few affected sheep.

Experimentally, foot-rot has been communicated to healthy sheep by portions of diseased tissue or moist discharge from an affected foot. One of the most successful of these experiments was that reported by Favre in 1823. He simply moistened the skin between the claws of 32 healthy sheep with matter obtained from the feet of diseased animals, and the result was that, in consequence of this slight exposure, 21 of them contracted the disease.

The discharge from affected feet contains millions of the germs which cause the disease, and therefore it is easy to understand why it spreads so rapidly amongst those flocks wherein the feet of individual sheep have become softened and irritated by prolonged exposure to moisture. Another convincing proof of the infective nature of the disease is the fact that lambs reared on infected ewes have been known to develop it within one week of birth.

Symptoms.

The first sign of an attack of foot-rot to attract attention is a slight lameness. Earlier, however, there will have appeared a moist area just above the horny part in the cleft of the foot, which will gradually redden and assume an inflamed appearance. This inflammation may appear at either the front or back part of the cleft, but usually it first shows at the heel. The lameness increases rapidly, the inflammation spreads, the foot above the hoof becomes swollen and hot, and in a little while the skin breaks down, the horn becomes underrun, and a thin foul discharge is noticed. This discharge contains pus cells, bits of destroyed foot tissue and bacteria, and its odour is so pungent and characteristic that if it be noticed an experienced sheep man needs no further confirmation of the presence of the disease.

If treatment is not applied during the early stage the horny covering of the foot becomes underrun with pus and loosened from the sensitive

structures underneath, while the softer tissues become broken down and purulent. The disease may continue to advance until the ligaments and tendons, and even the bones are attacked. Before this stage is reached, however, Nature will attempt to repair the damage and large quantities of new tissue will be formed.

Such unsuccessful attempts at repair are termed fungoid growths, and they have been known to hasten the shedding of the hoof by their persistent enlargement. In these acute cases of the disease the sheep finds the act of walking very painful, and if the front feet only are affected it will crawl around on its knees in an attempt to keep with the remainder of the flock or get within reach of its food. If the hind feet also are affected it will lie quietly in some secluded corner, and unless attended will slowly starve to death. In either case the temperature rises until there is considerable fever, and the animal loses condition rapidly. During warm weather, if the wool at the sides becomes soiled with the discharges from the feet, there is great danger of an attack of maggots, and unless they are quickly removed they will burrow into the skin and add to the suffering of the unfortunate animal.

In mild or chronic cases the hoof grows out rapidly and becomes very hard, and frequently the toes are so thickened and lengthened that the front part of the foot is raised above its natural level, the back tendons undergo continual strain, and the animal shows extreme lameness and awkwardness in movement.

Course.

Death from foot-rot is very rare. In the absence of treatment the course of the disease is usually slow and long. When a sheep becomes affected the trouble spreads from one foot to another, and gradually other sheep in the flock contract the disease, which, in this way, may remain active for several months in each member of the flock, and for eight or ten months in the flock itself. In some cases recovery may follow slowly, but usually most members of the flock are left with long mis-shapen feet and chronic lameness.

Treatment.

When treatment is applied in the early stages of the disease it is usually effective within ten days. One of the first steps to be taken is to separate all sheep which are in any way affected from those which are healthy. The feet of the healthy animals should be carefully trimmed, all excessive horn being removed and the sole of the foot made perfectly level. Horn-trimming shears may be procured for this purpose and will be found very useful. The sheep should be driven through a foot-bath or their feet should be dressed with a preventive mixture. The flock should then be placed directly on fresh uncontaminated pasture, and subsequently watched very carefully for signs of lameness. If the outbreak has been severe the healthy sheep should be mustered frequently, and carefully examined for evidence of the disease, and the foot-baths should be repeated. Any animal showing symptoms resembling the disease must be promptly removed from the flock and subjected to more careful treatment.

In the treatment of affected sheep it should always be remembered that the discharges, and any loose horn or diseased tissue pared away,

are highly infectious, and they must be carefully destroyed by burning or by placing them in a disinfectant solution. The affected foot should first be thoroughly cleaned by washing in an antiseptic solution; then all diseased and loose or under-run horn and tissue carefully cut away, in order that they may not remain a source of pain and inflammation, as well as a protective covering for the disease-producing organisms, which will enable them to multiply and burrow deeper. Abscesses should be opened and drained of pus, and excessive growths must be carefully removed with a knife or curved scissors. (Between operations all instruments should be kept in a 5 per cent. solution of carbonic acid or lysol.) The treatment outlined is sometimes difficult, but to be successful it must be carefully and thoroughly carried out. After the foot has been cleaned up in the way suggested a dressing should be applied. Many dressings have been recommended and used with success. In a test carried out on cultures of the organism which causes foot-rot, exposure for two minutes to a 2 per cent. solution of carbolic acid destroyed the organism, while a $2\frac{1}{2}$ per cent. solution of formalin killed the organism in thirteen minutes.

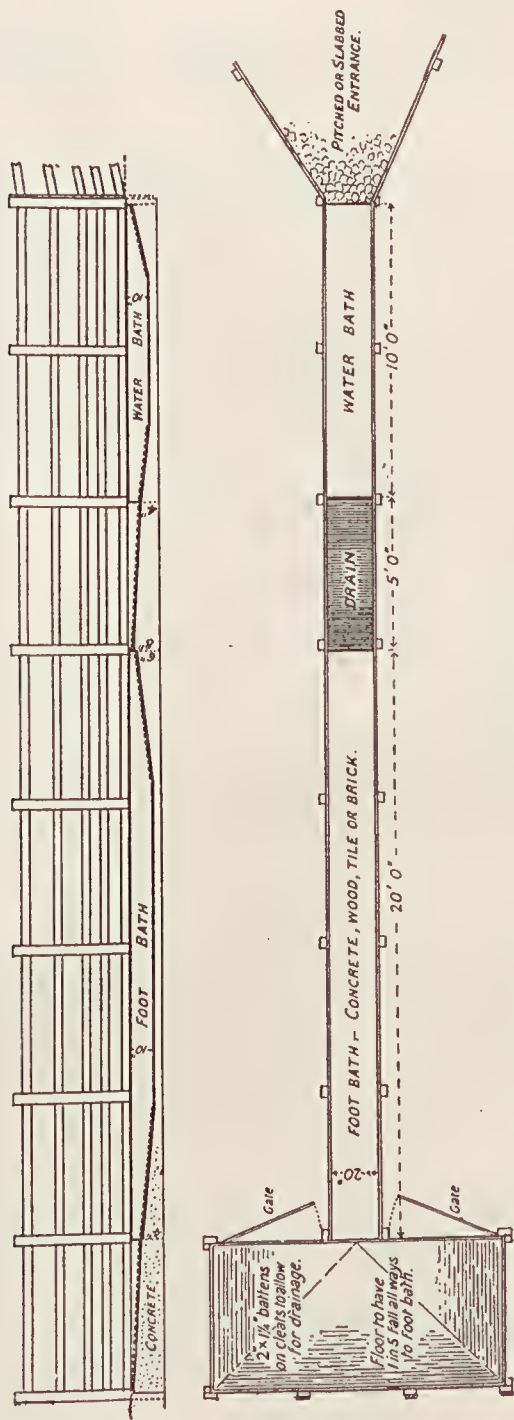
One flock-owner in Victoria whose ewes were so badly affected that during the spring months treatment every ten days was necessary, and whose lambs of only a few days old became infected, claims to have almost completely overcome the disease by the use of a 50 per cent. solution of formalin. Others have had success with a mixture consisting of one quart of Stockholm tar, 2 ounces of finely-powdered bluestone, and one tablespoonful of lysol or carbolic acid. The method of making this mixture is as follows:—Gently warm the Stockholm tar, and while stirring add the other ingredients slowly. The stirring should be continued for some time in order to ensure thorough mixing. The mixture should be painted on to the feet with a brush, and the sheep must be kept standing on a wooden or stone floor until the application is thoroughly dry.

Others have had success by standing the sheep for ten minutes in a strong solution of copper sulphate (bluestone), 3 lb. to 5 gallons, made as warm as can be borne by the hand. After treatment soft bandages should be applied to all feet that have needed deep cutting; this is necessary to protect the sensitive tissue and to prevent the entry of dirt until Nature has provided a new protective covering. In aggravated cases involving the deeper structures all loose and diseased tissue should be carefully cut away and the affected parts washed thoroughly in a 5 per cent. solution of carbolic acid. An antiseptic astringent powder consisting of four parts of carbolic acid, two parts of tannic acid, and 94 parts of dried pulverized alum is then dusted on and a bandage applied for protection.

One owner has recently had considerable success by the use of a boot made of canvas and fixed to the foot by means of a wire. A pad containing a dressing is placed in the boot in contact with the foot. This appliance has been placed on the market and may now be procured.

Prevention.

The prevention of foot-rot may be achieved by careful management. All freshly-purchased sheep should be kept in a separate paddock for



Plan of Foot-bath.

at least two weeks after arrival, and should be carefully examined for symptoms of the disease before being allowed to mix with clean sheep. If the disease is found among them they must be treated immediately and kept isolated for some considerable time after recovery is complete.

Experience has shown that sound sheep may safely be pastured on land that has previously been occupied by sheep suffering from foot-rot, provided that a winter's frosts have been allowed to intervene. Thus pastures that have become contaminated one season may be considered safe during the following season. The bacillus will retain its virulence in and around sheep-sheds and yards for several years, and therefore careful disinfection by spraying with a 5 per cent. solution of lysol is necessary after treatment of the animals has been discontinued. The manure should be removed and spread on cropping land before sheds and yards are sprayed with disinfectant. Where possible, low marshy lands should be avoided and sheep kept on high dry pastures.

If the disease is already present in the flock the most earnest efforts should be made to conquer it before the advent of warm weather, as it will be found more difficult to deal with during that period. Many owners have overcome the disease by frequent use of a foot-bath containing a solution of bluestone at the rate of 3 lb. of bluestone to every 5 gallons of water. The plan of a suitable foot-bath is shown on page 659. This bath consists of a long race divided into three parts; the first division is a water-bath 10 feet long, in which the feet are washed to get rid of mud, dust, &c. The sheep then pass over a draining division, 5 feet long, and then into the bath proper, which is 20 feet long, and contains the solution for treatment. From this the animals pass out into a draining pen. This pen may be constructed with two divisions, each capable of holding about 20 sheep. The animals are run from the bath into one of these pens until it is full, and held there while the other is being filled; in this way the sheep will be retained in the pen for at least five minutes.

The trough may be constructed of wood, concrete, brick, or tile (iron is unsuitable, because some of the solutions used corrode metal). It should be from 8 to 10 inches deep, and 20 inches wide at the top, with sides sloping so that the width at the bottom will be 8 inches. When required for use it should be filled to a depth of 4 inches with the solution prepared for use.

When the sheep's feet have been trimmed, &c., the animals should be passed slowly through the bath, care being taken that they do not walk through on three legs, or rush too quickly, or lie down. After passing through they should be held in a dry clean yard, until their feet are thoroughly dry; this precaution is necessary to guard against contamination of pastures by the poisonous mixture, and also against the removal of the dressing by the feet of the sheep brushing against grass, &c. They should then be placed in as clean a pasture as possible, and on no account in the paddock where the disease occurred.

The two essentials in the treatment and prevention of foot-rot are, first, an absolute understanding of the fact that the disease is highly contagious; and, secondly, the paring and preparation of the hoof, so that the dressing to be used may exert the greatest possible antiseptic action on the diseased parts.

POTATO MANURE TRIALS, 1929-30.

By J. T. Ramsay, Potato Expert.

The results of the manure trials for the past season are presented herewith. These were conducted on a wide range of soils throughout the State. The seasonal weather conditions were somewhat irregular. In the early portion of the growing period up to Christmas 1929 the rainfall was heavy and the temperatures low. In consequence growth during that period was slow. Following this cold spell a term of hot, dry weather prevailed through January to the second week in February with no rain. This had a most damaging effect, particularly on the early-sown crops, i.e., those sown prior to the end of October, and these, though benefiting from the February rains, were too far advanced, and because of that, were much affected with second growth. The later sown crops, November and December, were best suited by the seasonal conditions, and some very heavy yields were obtained from these.

MILLBROOK.

At Millbrook, the main experimental station, the results were only moderate. At this station, as well as others having rich volcanic soils, an alteration was made during the last three seasons in the rate of manuring applied to the crop. This followed on the evidence previously obtained of the fact that these rich soils do not respond to or require heavy dressings, particularly of superphosphate.

The result of the manure trials at Millbrook are given below in Table I. From these it will be seen that the moderate manuring with superphosphate at the rate of 3 cwt. per acre in conjunction with 1 cwt. sulphate of ammonia gave the best results for the past season. It is curious, but nevertheless a fact, that applications of superphosphate to this soil in excess of 3 cwt. per acre actually has a depressing effect on the crop, but up to that weight a distinct benefit is obtained. The percentage increases are not only significant, but material, no less than 84 per cent. increase being obtained from the "3 and 1" dressing. The analysis of the Millbrook soil is as follows:—

SOIL ANALYSIS, MILLBROOK.

				Parts per 100,000.	For comparison a good soil should contain—
Nitrogen	..	..	143	..	150
Phosphoric Acid	..	..	180	..	150
Potash	..	..	249	..	250
Lime	..	..	176	..	—

From this it will be seen that on chemical analysis the Millbrook soil would appear to be fortified with a sufficiency of plant food, yet the yields from it can be augmented by judicious applications of fertilizers as shown in Table I.

TABLE I.—RESULTS OF MANURE TRIALS AT MILLBROOK, SEASON 1929-30.
Conducted on the farm of Mr. P. J. Ryan. Soil, red volcanic loam.

Manures.	Market Tubers.	Increase from Manures.	Cost of Manure per Acre.	Cost per Ton Increase.	Increased Value per Acre.	Net Increase Value per Acre.	Per- centage Increase.
Per acre.	T. C. Q.	T. C. Q.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	%
1.—2 cwt. super. ..	4 11 1	1 12 1	0 9 6	0 6 0	8 1 3	7 11 9	56
2.—3 cwt. super. ..	5 0 0	2 1 0	0 14 3	0 7 0	10 5 0	9 10 9	69
3.—4 cwt. super. ..	4 8 1	1 9 1	0 19 0	0 13 0	7 6 3	6 7 3	49
4.—No manure ..	2 19 0	..	..	..	..	..	..
5.—3 cwt. super., 1 cwt. sulph. ammon. ..	5 9 0	2 10 0	1 7 0	0 10 9	12 10 0	11 3 0	84
6.—3 cwt. super., 1 cwt. ammon. sulph., 1 cwt. pot. sulph. ..	5 0 0	2 1 0	2 1 6	0 7 0	10 5 0	8 3 6	69
7.—3 cwt. market garden manure ..	5 0 0	2 1 0	1 5 6	0 12 6	10 5 0	8 19 6	69
8.—3 cwt. basic phosphate	3 16 2	0 17 2	0 16 6	0 18 9	4 7 6	3 11 0	28

Returns calculated at £5 per ton.

It is now possible to give the results of these manurial variations at Millbrook for three years and the average of same for that period which is a figure of much greater value than the result of any one year. Table II. gives these details.

TABLE II.—POTATO MANURIAL TRIALS AT MILLBROOK.
Average for Three years, 1928 to 1930.

	1. 2 Cwt. Super. per Acre.	2. 3 Cwt. Super. per Acre.	3. 4 Cwt. Super. per Acre.	4. No Manure.	5. 3 Cwt. Super., 1 Cwt. Sulph. Ammon. per Acre.	6. 3 Cwt. Super., 1 Cwt. Sulph. Ammon., 1 Cwt. Pot. Sulph. per Acre.	7. 3 Cwt. Market Garden Manure per Acre.	8. 3 Cwt. Basic Phos. per Acre.
	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.
1927-28 ..	4 13 3	5 12 2	5 10 0	3 15 0	7 2 0	6 0 2	4 5 3	4 0 1
1928-29 ..	1 5 2	1 13 2	1 8 0	1 1 1	1 12 0	1 12 0	1 8 0	1 4 0
1929-30 ..	4 11 1	5 0 0	4 8 1	2 19 0	5 9 0	5 0 0	5 0 0	3 16 2
Average for three years ..	3 10 0	4 2 0	3 15 1	2 11 3	4 14 1	4 4 0	3 11 1	3 0 1
Percentage Increase ..	35%	58%	45%	..	81%	62%	37%	16%

The average percentage increase in favour of the "3 and 1" mixture, it will be noted is very marked. The rise in yield from 35 per cent. from 2 cwt super. to 58 per cent. from 3 cwt. super., and the fall back to 45 per cent. from 4 cwt. super. is interesting, while the high average increase of 81 per cent. in favour of the "3 and 1" dressing is outstanding. Another marked feature of the Millbrook trials (also obtained at other stations) is the failure of potash sulphate to justify its use. On the three years' average at this station, potash, in conjunction with super. and ammonia, has shown a decreased average of no less than 19 per cent., as compared with the "3 and 1" dressing by itself.

TABLE III.—VARIETAL TESTS, MILLBROOK, 1929-30.

Manure applied, 3 cwt. super. per acre.

	t.	c.	q.
Earliest of All	4	5	1
Beauty of Hebron	2	1	1
Carmen No. 1	2	1	1
Late Hebron	4	11	1
Brownell's Beauty	2	19	0
Excelsior	3	16	2
Wellington	2	19	0
Late Manistee	8	5	0
Brown's River	4	2	2
Manhattan	5	6	0
Scottish Triumph	5	17	3
American Rose	5	6	0
Arran Chief	4	8	1
Arran Victory	3	16	2
Up-to-date	7	12	3
Plunkett	6	3	3
Great Scott	2	19	0

A further test was carried out last season to demonstrate the advisability of planting seed as soon as possible after cutting. The results further substantiate the findings of other years. In practically every instance in which this test has been made there has been a considerable increase in crop where the seed was planted immediately after cutting. The figures this year again show a progressive diminution of crop, as the time between the cutting and planting increases, and each of the reductions is very noticeable. Table IV. gives the returns.

TABLE IV.—TIME OF CUTTING TEST, 1929-30.

Variety, Late Carmen. 3 cwt. super. per acre.

	t.	c.	q.
Fresh cut seed	5	0	0
Cut one week	3	10	2
Cut two weeks	2	19	0
Cut three weeks	1	15	2

The cultivation test again proves the soundness of the practice of giving sufficient intercultivation to the crop during the growing period. In this case three cultivations with the horse-hoe gave the substantial increase of 48 per cent., as compared with one cultivation only.

TABLE V.—CULTIVATION TEST, 1929-30.

Variety, Late Carmen. 3 cwt. super. per acre.

	t.	c.	q.	Percentage Increase.
One cultivation	3	13	2	—
Two cultivations	4	8	1	20
Three cultivations	5	9	0	48

Considering the small cost per acre of horse-hoeing (about 4s. per acre) the increased crop resulting from this cultivation must be admitted to be a highly profitable investment.

TABLE VI.—BOXED *versus* BAGGED SEED, 1929-30.

	t.	c.	q.
Boxed seed	5	0	0
Bagged seed	1	9	2

The tremendous difference in the performance of these two classes of seed last season is more than can usually be expected. It is probably explained in part by the fact that very mild temperatures obtained in the latter part of the storage period, with the result that the growth of sprouts, in the case of the bagged seed, was in consequence excessive, and suffered severely in the handling incidental to planting. However, the fact remains definitely proved that the boxed system of seed storage keeps the seed in the best of condition with unimpaired vitality. The increased yield resulting from the adoption of the boxing system may be safely estimated to be at least 2 tons per acre on the average. Phenomenally good results were obtained at Millbrook from the dipping of seed. The dipping solution used was formalin, 1 lb. to 20 gallons of water, and the period of immersion was $1\frac{1}{2}$ hours. The dipped seed produced a fine clean sample with the weight per acre far in excess of the undipped seed. The prevalence of *Rhizoctonia* (collar-stem rot) in Victoria calls for activity in combating it, and it is gratifying to find the increased interests shown by growers this season.

TABLE VII.—DIPPED *v.* UNDIPPED SEED.

				t.	c.	q.
Dipped seed	..	..	..	..	5	0 0
Undipped	..	..	..	..	1	10 0

TABLE VIII.—MILLBROOK POTATO TRIALS, 1929-30.
REPLICATED MANURIAL TRIALS.

Calculated by Messrs. Forster and Vasey, Research Farm, Werribee.

Treatment.	Average Yield per Acre.	Control.	Average Yield per Acre.	Increase over Control.	
				Per Acre.	Percentage Increase.
3 cwt. super., 1 cwt. ammon. sulph.	Cwt. 107.0	No manure	Cwt. 56.4	Cwt. 50.6	90 Sig.
3 cwt. super.	102.0	"	55.4	46.6	84 Sig.
3 cwt. super., 1 cwt. ammon. sulph., 1 cwt. pot. sulph.	98.4	"	56.4	42.0	74 Sig.

Comments on Replicated Manurial Results.

Manurial Treatments which have been applied to potatoes during the past two years at Millbrook have shown—

- (1) that a combination of 3 cwt. of super. and 1 cwt. of ammonia sulphate has proved the most profitable, increasing the yield over no manure by 58 per cent. in 1929, and by 90 per cent. during 1930;
- (2) that ammonia sulphate produces an increase over super. alone;
- (3) that potassium sulphate, during the past two years, has shown a definite significant decrease in yield over the other manured plots. The trial shows that it reduced the yield of the super. and ammonium sulphate plot by 13 per cent. during 1929 and by 15 per cent. during 1930.

ROMSEY.

Unfavorable seasonal conditions affected the trials at this station adversely, and as a result the yields were very light. Their significance, therefore, is not great. As the soil in this district is somewhat similar to that at Millbrook, it may be expected that, given favorable seasons, the returns will approximate to findings at the latter place.

SOIL ANALYSIS.—ROMSEY.

	Parts per 100,000.
Nitrogen	131
Phosphoric Acid	76
Potash	176

TABLE IX.—RESULTS OF MANURE TESTS ON POTATOES AT ROMSEY.
SEASON 1929-30.

Conducted on the farm of Messrs. Sprung Bros. Soil, red volcanic loam.

Manures.	Market Tubers.	Increase from Manures.	Cost of Manure per Acre.	Cost per Ton Increase.	Increased Value per Acre.	Net Increased Value per Acre.	Per- centage Increase.
	T. C. Q.	T. C. Q.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	%
1.—2 cwt. super. ..	3 12 3	0 12 3	0 9 6	0 8 1	3 15 0	3 5 6	21
2.—3 cwt. super. ..	3 8 0	0 8 0	0 14 3	1 15 7	2 0 0	1 5 9	13
3.—4 cwt. super. ..	3 5 3	0 5 3	0 19 0	3 3 4	1 10 0	0 11 0	10
4.—No manure ..	3 0 2	..	..	..	..	..	..
5.—3 cwt. super., 1 cwt. ammon. sulph. ..	3 6 2	0 6 0	1 7 0	4 10 0	1 10 0	0 3 0	10
6.—3 cwt. super., 1 cwt. ammon. sulph., 1 cwt. pot. sulph. ..	3 6 2	0 6 0	2 1 6	6 18 4	1 10 0	0 11 6	10
7.—3 cwt. market garden manure ..	3 0 2	Nil	1 5 6	-1 5 6	-1 5 6	-1 5 6	..
8.—3 cwt. basic phosphate	3 0 2	Nil	0 16 6	-0 16 6	-0 16 6	-0 16 6	..

Values calculated at £5 per ton.

TABLE X.—RESULTS OF POTATO MANURIAL TRIALS AT ROMSEY.
TWO YEARS, 1928-30.

Season.	1. 2 Cwt. Super. per Acre.	2. 3 Cwt. Super. per Acre.	3. 4 Cwt. Super. per Acre.	4. No Manure.	5. 3 Cwt. Super., 1 Cwt. Sulph. Ammon. per Acre.	6. 3 Cwt. Super., 1 Cwt. Pot. Sulph., 1 Cwt. Sulph. Ammon. per Acre.	7. 3 Cwt. Market Garden Manure per Acre.	8. 3 Cwt. Basic Phos. per Acre.
	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.
1928-29 ..	2 16 1	3 1 2	2 18 3	1 17 2	3 1 2	..	2 13 2	2 13 2
1929-30 ..	3 12 3	3 8 0	3 5 3	3 0 2	3 6 2	3 6 2	3 0 2	3 0 2
Average for two years ..	3 4 2	3 4 3	3 2 1	2 9 0	3 4 0	3 6 2	2 17 0	2 17 0
Percentage Increase ..	31%	32%	26%	..	30%	33%	16%	16%

TRENTHAM.

The Trentham returns show the greatest increase in crop from the application of superphosphate alone at the rate of 3 cwt. per acre. The results are given below for the season 1929-30 (Table XI.), and also the average results for a three-year period:—

TABLE XI.—RESULTS OF MANURE TESTS ON POTATOES AT TRENTHAM EAST, 1929-30.

Conducted on the farm of Messrs. O'Brien. Soil, red volcanic loam.

Manure per Acre.	Market Tubers.	Increase from Manure.	Cost of Manure. per Acre.	Cost per Ton Increase.	Increased Value per Acre.	Net Increased Value per Acre.	Percentage Increase.
	T. C. Q.	T. C. Q.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	%
1.—2 cwt. super. ..	7 15 0	3 1 0	0 9 6	0 3 0	15 5 0	14 15 6	65
2.—3 cwt. super. ..	8 0 0	3 6 0	0 14 3	0 4 3	16 10 0	15 15 9	70
3.—4 cwt. super. ..	7 5 0	2 11 0	0 19 0	0 7 4	12 15 0	11 16 0	54
4.—No manure ..	4 14 0	..	..	..	..	..	..
5.—3 cwt. super., 1 cwt. ammon. sulph. ..	7 5 0	2 11 0	1 7 0	0 10 6	12 15 0	11 8 0	54
6.—3 cwt. super., 1 cwt. ammon. sulph., 1 cwt. pot. sulph. ..	6 15 0	2 1 0	2 1 6	1 0 0	10 5 0	8 3 6	43
7.—3 cwt. market garden manure ..	6 7 2	1 13 2	1 5 6	0 15 4	8 7 6	7 2 0	35
8.—3 cwt. basic phosphate	6 7 2	1 13 2	0 16 6	0 10 0	8 7 6	7 10 0	35

At £5 per ton.

TABLE XII.—RESULTS OF MANURIAL TRIALS AT TRENTHAM EAST. THREE YEARS, 1927-30.

Season.	1. 2 Cwt. Super. per Acre.	2. 3 Cwt. Super. per Acre.	3. 4 Cwt. Super. per Acre.	4. No Manure.	5. 3 Cwt. Super., 1 Cwt. Sulph. Ammon. per Acre.	6. 3 Cwt. Super., 1 Cwt. Pot. Sulph., 1 Cwt. Sulph. Ammon. per Acre.	7. 3 Cwt. Market Garden Manure per Acre.	8. 3 Cwt. Basic Phos. per Acre.
	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.
1927-28 ..	5 0 0	6 12 2	5 17 2	1 10 0	7 5 0	6 17 2	4 0 0	4 12 2
1928-29 ..	1 9 1	1 12 2	1 7 2	0 5 0	1 10 2	1 1 3	1 0 0	0 18 1
1929-30 ..	7 15 0	8 0 0	7 5 0	4 14 0	7 5 0	6 15 0	6 7 2	6 7 2
Average for three years ..	4 14 1	5 8 1	4 16 2	2 3 0	5 6 3	4 18 0	3 15 3	3 19 1
Percentage Increase ...	119%	151%	123%	..	143%	128%	76%	84%

(To be continued.)

TOP-DRESSING STRAWBERRY CLOVER.

By H. C. Churches, Dairy Supervisor.

Any method of improving our pastures, or of "making two blades of grass grow where one grew before," is certainly deserving of every consideration. As far as we know at present, the simplest and most profitable way to increase the returns from pastures is to top-dress them with artificial manure—chiefly superphosphate.

Dairy cattle, particularly, show a strong preference for top-dressed pastures, which is evidently due to their higher food content, especially in the part of phosphate of lime, an element lacking in many Victorian soils; in some the deficiency is very great.

Every gallon of milk a cow produces contains approximately 18 oz. of mineral matter; thus one yielding only 500 gallons in a year gives out about 35 lb. If she is unable to obtain sufficient mineral matter from the pastures on which she is grazing, she will develop what may be called a depraved appetite, and seek phosphates from bones, dead rabbits, sticks, &c. I have even seen cattle licking up dry fowl manure that had been carted out on to the pastures for top-dressing.

A good pasture should contain abundance of clover and trefoils, as well as grasses. Clovers and trefoils are rich in protein and lime, both of which are extremely essential for milk production. It is from the protein portion of a foodstuff that an animal obtains the material for flesh and milk-making; the lime is needed for bone and milk-making. Clovers and trefoils are very sensitive to phosphatic deficiency in the soil, and they respond in a marvellous way to applications of superphosphate.

There are numerous varieties of clovers and trefoils, and although some of them may have a decided preference for a particular climate and type of soil, they all appear to have the same liking for phosphatic manures.

Though a valuable fodder plant, strawberry clover is, perhaps, not so generally known or grown as others, such as the burr trefoils and subterranean clover. It will not thrive on plain country or high ground. It likes damp, flat land, and low-lying positions subject to floods. In localities that suit it, it is an estimable plant, having many qualifications. Though flood waters cover it for weeks in the winter, they will not destroy it; it will even recover after having been covered for some weeks with sludge and debris from a flood; it will grow amongst tussocks and other rubbish; it will often establish itself on salty, damp ground when no other useful plant will do so; and sometimes it will grow in swampy land where previously there were no plants other than those that may be classed as water weeds. If these wet places dry out in summer, the clover may be grazed to the ground, and yet the root growth will not be destroyed. All classes of stock are very fond of it.

Strawberry clover may be grown from seed, but it can be more quickly established by slips and roots placed at intervals of 4 or 5 feet in the soft wet ground during the late autumn or early spring.

Mr. J. McDougall, of Byaduk, who top-dresses his high-ground pastures with beneficial results, has a small area of damp flat land which is inclined to be of a salty nature, and through which a small brackish "soak" or spring runs. Strawberry clover was introduced into this flat a few years ago, and although it established itself fairly evenly throughout the area, did not grow strongly. Mr. McDougall decided on a little experiment, and early in October last he top-dressed the flat, applying by hand approximately 1 cwt. of superphosphate to the acre. In order that the effect of the manure could be noted, he left a strip to which no manure was applied. The result of the top-dressing has been very gratifying to him. The difference between the top-dressed portion and the strip to which no manure was given is conspicuous, even to the most casual observer.

The preference shown by the cows for the top-dressed portion is particularly noticeable. It is the first instance that has come under my notice of top-dressing this class of pasture, and it would indeed be interesting if others having strawberry clover in their paddocks—even though only small plots about creek frontages or "soaks"—would try the experiment. Strawberry clover is well worth encouraging in pastures, as it is usually green during the summer, when most of the plants on the high ground have dried up.

HERD IMPROVEMENT BY CULLING.

By A. Snodgrass, Dairy Supervisor.

Though it has had to wait long, the Department of Agriculture has at last seen its persistent advocacy of herd-testing vindicated in the increased production that has everywhere attended the extensive adoption of the practice throughout the State.

Herd-testing is certainly the means of herd improvement, but one must not suppose that the testing and weighing of milk are all that is necessary. Even more directly than on testing, improvement depends on the more scientific culling which logically follows testing, and which, in fact, must wait on herd-testing. Culling is just as essential as testing; one is of no use without the other. It may happen that culling will not be of much use, even with herd-testing, unless what should always be the objective—a herd of maximum producers—be kept in view.

So important is culling in the work of herd improvement that it must be regarded as an art in itself. The butter-fat consideration is, of course, the main one in culling for dairy purposes; but, in aiming at heavy yields, there are certain characteristics other than just current

butter-fat records to be thought of. One of these is the age of the animal, and this has a very important bearing on her present value as a dairy cow. The age factor will, of course, generally be allowed to give way to that of yield when the difference in yield exceeds a certain figure.

After a herd has been tested for a few years, and the necessary culling has been carried out, the butter-fat production of the individual cows will tend to become more even. If a pure-bred sire from a heavy butter-fat-producing family be mated with the cows, the resulting heifers may reasonably be expected to improve on the production figures of their dams. When the breeder-dairyman has reached this stage of breeding, testing and culling, he must, if he is to continue to improve his herd and receive the full benefit from his efforts, rear practically all of each year's heifer calves. Most dairymen have only a strictly limited area of land, and if they rear all the heifer calves of a normal or 50 per cent. drop, their farm will soon become overstocked.

The method best followed generally to avoid overstocking, and to keep a herd young and sound, and to maintain improvement in production, is, other things being equal, to sell yearly the oldest cows in a herd. I would suggest that a heifer of even no more than equal promise should always be preferred to a cow six years old when, in ordinary circumstances, she would be coming in with her fifth calf. This method has much to recommend it, and it is carried out very successfully in some of the older dairying countries of the world. A cow six years old is about in her prime, and with good butter-fat records to her credit, should command quite a good price from dairymen who are making a beginning, or from those who do not breed their own dairy stock.

As a rule, the troubles which are liable to incapacitate dairy cows are found amongst the older animals, especially if they have been producing to the utmost for a number of years. When some cows have reached their sixth year, their teeth begin to wear down; others lose them, and if the grass be any way short, they are unable to get as much as they could eat; consequently, they will not yield so well as a younger cow with a full set of good teeth. A good producer generally has a large udder, and when she begins to get old, the suspending ligaments stretch, and the udder becomes pendulous, and is bumped more or less from side to side as the cow walks. Besides liability to injury, a swinging udder is liable to become soiled during wet weather. Age, therefore, is a factor in udder troubles.

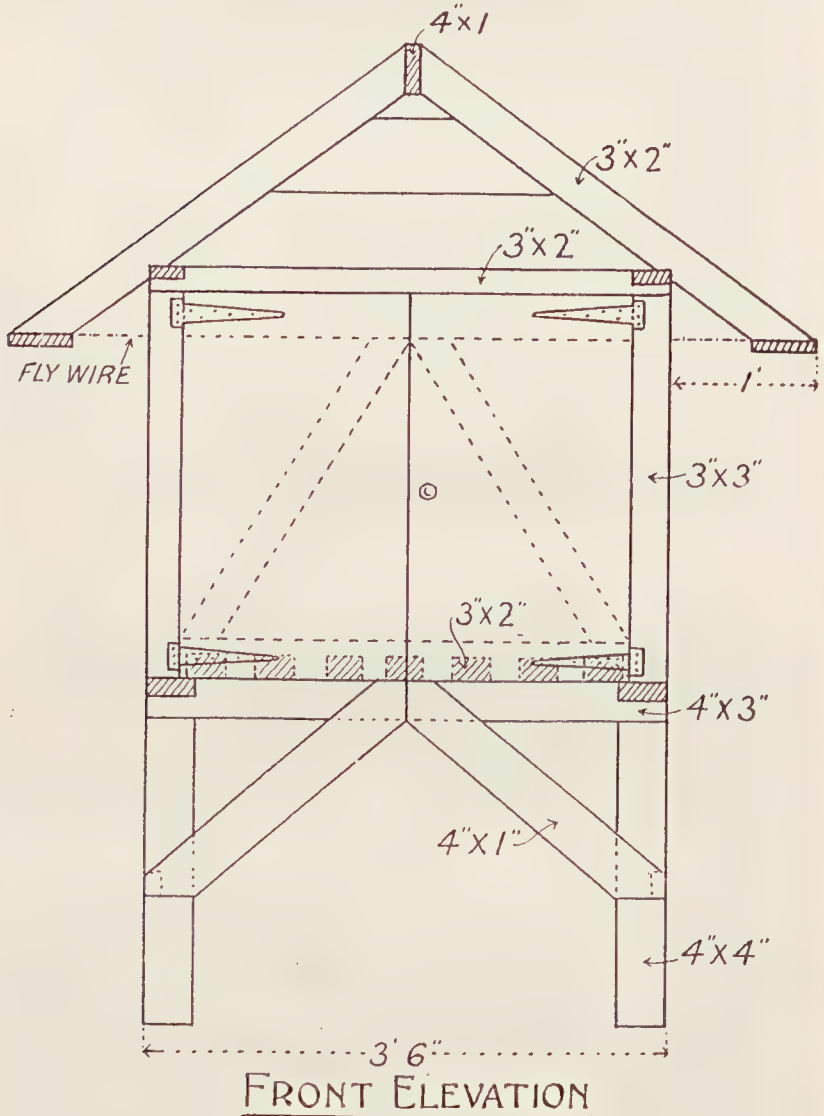
At the present market value of dairy cattle a good six-year-old cow should bring £16, and her place in the herd could be taken by a two-year-old heifer whose cost of rearing may be set down at approximately £6.

On cattle-breeding stations similarly, breeding cows are best fattened when they are five or six years old, before their beef deteriorates in value, assuming, of course, that animals at least as good are available to take their places. As far as the buyer of dairy cows is concerned, the six-year-old animal would be as acceptable to the young dairyman as heifers would be, particularly animals with good records bred on the same farm. The fact, of course, is that youth in a cow has a value to an established dairyman that is not always fully appreciated by buyers.

ROADSIDE CREAM STORAGES.

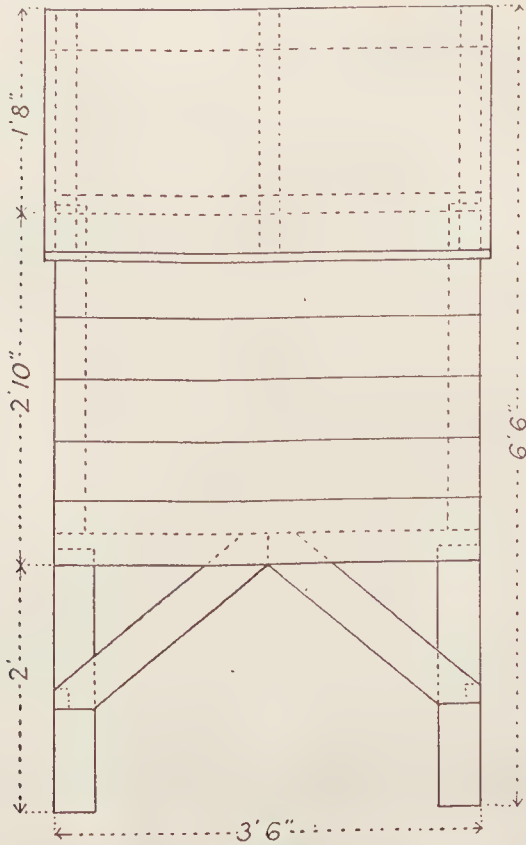
By J. J. Nolan, Dairy Supervisor.

The provision of reasonable and suitable roadside shelter for cream has received rather scant consideration by dairy-farmers in many parts

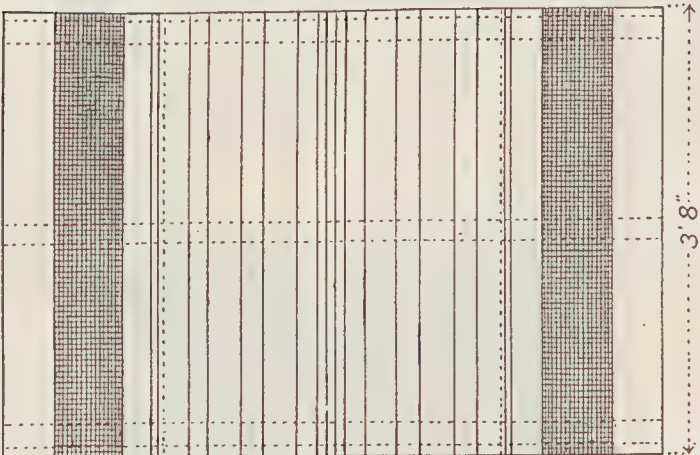


SCALE. $\frac{3}{4}'' = 1'$

of Victoria, and it is to be hoped that this urgent matter will receive attention before the season advances much farther.



SIDE ELEVATION



GROUND PLAN

FLY WIRE

In many cases, owing to the isolated position of farms and to roads being unfit for vehicular traffic, cream has to be sledged to the main thoroughfares for collection.

In some places, a rough shelter is provided, but often it is unsuitable for its purpose. In others, no covering of any kind is available, and there the cream will occasionally remain in the open on the hot ground and exposed to the sunshine, maybe for several hours.

The value of such cream for butter-making is greatly diminished. Unfortunately, in practice, the whole loss is not visited entirely on the supplier; the suppliers of good cream will in the final reckoning bear a share of it, for first class butter cannot be made from inferior cream; thus the loss becomes a national as well as an individual one.

An efficient roadside shelter may be built cheaply, and the outlay would be recouped by the losses it would guard against in perhaps one season.

In those localities where a few farmers can deliver their cream at one point, a common shelter could be built at a cost much lower than the combined cost of several small shelters. An advantage of a common shelter is that it means fewer stops for the factory wagon, and a consequent earlier delivery of the cream at its destination.

The plan on page 670 is for a small hardwood structure 3 feet high, with a floor 3 ft. 6 in. square. It should be fixed on top of a stand placed on four sound posts 2 feet above the ground level. The floor could be made from four pieces of 4-inch x 3-inch hardwood, with 3-inch x 2-inch cross pieces set about 2 inches apart.

The roof may be of the gable or lean-to type according to situation. If in the open, the gable roof which overhangs the walls by 9 inches to 12 inches is recommended. The top board on either side is left off, and a piece of flywire attached horizontally from the wall to end of the iron, where a piece of 4-inch x 1-inch timber has been fitted. Two small doors are provided on the front, opening to the full width of the structure. A shelter of this size would hold four cans of cream.

Highly-scented resinous timber should be avoided, as it is liable to impart a taint to the cream. If the walls and roof be given a coating with a good white paint, their heat-resistance and durability will be greatly increased. An occasional application of limewash to the interior will help to keep the shelter in a sanitary condition.



PRUNE DRYING.

(Continued from p. 622.)

*By F. de Castella, Horticultural Division.***Artificial Drying.**

Artificial drying is more complicated, especially in its recent developments, for there are many different systems. A distinction must be made between the discontinuous or French type and the American continuous driers, of which the "Tunnel" is the best-known example. The French type will be described later, in a special section; it is the American dryers that now concern us. It is in America that the highest stage of development has been reached; the modern de-hydrator has been gradually evolved from the primitive kiln, on similar lines to that used for drying hops, &c. An early improvement was the stack or vertical arrangement, in which the trays of fresh fruit enter at the top, whilst the finished prunes are removed from the bottom, a special lifting arrangement raising the whole stack whilst the bottom tray is withdrawn. This system was in turn superseded by the tunnel, on which principle nearly all modern American drying plants are now constructed. A tunnel may be summarily described as a long, sloping, heated chamber or passage, in which the trays of prunes and the hot air circulate—usually in contrary directions. The lower end of the tunnel is situated directly over the stove or hot-air generator. In older types the trays were pushed forward on cleats or rollers fixed to the sides of the tunnel; in the modern ones the trays are stacked on cars or trucks, that move forward through the tunnel, entering with the fresh fruit at the higher end and leaving at the lower end with the almost finished prunes, which only need final processing to be ready for market.

These modifications and improvements have cheapened the drying process in the direction of fuel and labour economy; they also permit the turning out a better quality product. The old Californian prejudice against artificial drying and preference for sun drying was largely due to the inefficient driers first used, which were designed to supplement sun drying when weather conditions were unfavorable. The prunes they turned out were inferior and uneven. In colder Oregon, artificial drying imposed itself, and it is in this State that the "tunnel," often spoken of as the "Oregon tunnel," seems to have been evolved.

According to Creuss* it was invented by Allen about 31 years ago, and is often known by his name. . . . Each tunnel is about 20 feet long by about 5 feet in height and about 3 feet in width, and slopes approximately 2 inches per foot. At one time tunnels were much longer than 20 feet, but more rapid and uniform drying is obtained by the shorter tunnels.

In the earlier types of tunnels the circulation of the hot air depended on natural draught. This being insufficient to evacuate the moisture-laden air fast enough, was often the cause of uneven drying. It has been replaced by mechanical draught caused by power-driven fans or blowers, either of propeller or centrifugal type, which are now in general use. For reasons given below, the hot air in the tunnel must not be

* *Commercial Fruit and Vegetable Products*, by W. V. Creuss, University of California, 1924, see page 332.

too dry. Hence the application of what is known as "re-circulation," or the blending in of a certain proportion of hot, moisture-laden air, that has already passed over the fruit, with the fresh dry air drawn or driven into the heating chamber from the outside.

In America there are many types of de-hydrator, most of which are protected in whole or in part by patents. Christie advises care so as to avoid legal entanglements by unauthorized duplication of patented features.

The modern American de-hydrator has thus reached a stage of complexity almost bewildering at first sight. Notwithstanding its necessarily high first cost, it is economical to work, both as regards fuel and labour, and has permitted the turning out of a highly standardized product of very fair quality.



Fig. 5.—Small Tunnel Evaporator (L. J. Eddens, Dundee, Oregon, U.S.A.).

For dimensions, see Figs. 7 and 8. Air circulation is by natural draught. Heating is by two brick furnaces, 8 feet long, with runs of pipe (15 inches, narrowing to 13 inches). The distance of 8 feet between these and the tunnel gives a good-sized mixing chamber, and minimizes the danger of scorching. For air-intake there are eighteen openings each 1 foot square. Note ventilator in roof; it is divided, giving a separate shaft for each tunnel, of which there are seven.

[Reproduced from Bulletin 145.—The Evaporation of Prunes—Oregon Agricultural College.]

It must be recognized, however, that, notwithstanding its ingenious complexity of design, its efficiency, and economical working, the prune turned out by the continuous American de-hydrator does not equal in quality the French prune, dried in the much less elaborate discontinuous appliances of the Agen district of France, less economical though they may be as regards fuel, and less convenient for the handling of large quantities of fruit. Whether the superiority of the French prune is entirely due to the special drying method (described below) is not clear. The cool climate of Agen, and consequent thinness of skin, may be in part responsible, and possibly also the plum sort, for it seems almost certain that the plum grown here and in California under the

name of prune d'Agen is not identical with the prune d'Ente, from which all Agen prunes are now dried.

A detailed description of the very complicated modern prune drying plants is here impossible, but a summary description of some of these, and a brief outline of the principles governing their functioning, may not be out of place. A distinction must first be made between vacuum- and air-driers. For prunes, the second are always used. Vacuum-driers are only really necessary for meat and such other substances as would be injured by high temperature.

Some American writers distinguish between evaporators dependent on natural draught and de-hydrators in which temperature, relative humidity, and air velocity can be accurately controlled. These are indeed the three points of cardinal importance in the artificial drying of fruit, especially in driers of the tunnel type.

As is patent to all, the hotter and drier the air, the more rapid the evaporation of water. It would therefore appear that an efficient dryer should work at high temperature and low humidity. The question is, however, not so simple as it seems at first sight, and both temperature and air dryness need to be carefully controlled; excess in either direction being detrimental to quality, to yield, and to the economical functioning of the drying plant.

TEMPERATURE.

Excessive temperature may lead to actual loss through caramelization of the sugar—that change characteristic of the making of toffee. There is a critical temperature at which fruit sugars, especially levulose, undergo caramelization. According to Christie,* this loss is to be feared at temperatures over 160 deg. F. “However, the sugar in prunes will not be affected by temperatures considerably in excess of 160 deg. so long as the prunes are continuing to give up moisture freely.” On the “water-bag” principle, the prunes do not then reach the temperature of the surrounding air. When nearly dry, this protection ceases; “for these reasons it has been found unsafe to finish prunes at a temperature above 165 deg. F., which has been adopted as a standard.”

At the commencement of drying, too high a temperature is undesirable, because the sudden expansion may cause the juice to exude. “Dripping” then occurs, resulting in loss of weight and sticky fruit and trays.

Excessive temperatures also arrest the desired darkening of the skin, so that prunes dried too rapidly, at high temperature, develop a reddish-brown rather than a black skin. Christie recommends to enter the prunes at the cooler end of the de-hydrator, usually at 120 deg. F. to 140 deg., and to move them progressively towards the highest temperature for finishing.

Too low a temperature, on the other hand, necessitating too long a drying time, is not economical, and may even lead to fermentation trouble and the development of moulds.

HUMIDITY.

The drier the hot air the more rapid the evaporation, and yet with humidity below a certain point the quality of the product suffers.

* Loc. cit. p. 41.

Case-hardening is the term given to this form of injury. Its occurrence is explained by Christie, as follows:—

The cellular structure and syrupy nature of fruit tissues retard evaporation, so that the rate of evaporation is less than from a free water surface. When surface evaporation from the tissues exceeds the rate of moisture diffusion to the surface, the latter thus becomes dry and hard, and tends to retard drying. . . . Case-hardening, however, is a temporary condition not necessarily associated with injury to quality. It disappears during subsequent binning and processing, and is not to be feared, provided the flesh around the pit is sufficiently dried.* Experiments are described, which proved that prunes finished at 40 per cent. humidity showed no case-hardening and considerably stickiness, those at 25 per cent. considerable case-hardening and slight stickiness, and those at 10 per cent. severe case-hardening and no stickiness. However, case-hardening disappeared after the prunes had equalized in bins for several weeks.† It is recommended that the humidity in prune de-hydrators be not allowed to exceed 25 per cent. at a temperature of 165 deg. F., equivalent to a wet-bulb temperature of 118 deg. F.‡

According to Wiegand§—

Moisture is generally considered an enemy of drying. Moisture in the circulation lessens evaporation . . . but in certain amounts it can increase it, by permitting a steady and uniform conduction and diffusion. Under these conditions, a better quality prune will be produced. Moisture influences quality and economic production by—(1) preventing case-hardening, and (2) increasing the conductivity of the air. The better conduction is due to the greater specific heat of the moist air, which is considerable. The specific heat of water vapour is nearly double that of dry air.

Hence the importance of re-circulation, concerning which more presently. The moisture-content of the air in the drier is measured by means of the wet- and dry-bulb thermometer, with the aid of tables compiled for the purpose.

AIR CIRCULATION.

In the earlier tunnels, dependent on natural draught, the air circulation was too slow, and the progress of drying was uneven. Its replacement by forced draught, constituted an important advance, which soon met with very general adoption. American authorities consider that the air velocity should be in the neighbourhood of 600 to 700 lineal feet per minute.

According to Christie||—

"All modern air-blast de-hydrators show an average air velocity between trays of 500 lineal feet per minute or over, generally 600 to 700. Velocities below 500 feet are generally associated with slow and uneven drying, while velocities in excess of 1,000 feet are not economically practicable." . . . He distinguishes between static pressure, measured by the pitot tube in inches of water column, and velocity pressure. In good average practice the static pressure is about 1.5 inches. The stacks of trays should, as nearly as possible, fill the entire cross-section area of the drying chamber . . . flexible baffles of discarded belting or hose can be used to prevent excessive flow of air over the top-trays, along the walls, and under the cars . . . every effort should be made to cause all the air to flow between the trays.

The hot air may be made to circulate according to four different systems:—¶

(1) *Counter Current*.—The fruit entering at one end at a comparatively low temperature and advancing in contrary sense to the air current, finishing at the maximum temperature.

* Christie p. 42.

† Ibid. p. 43.

‡ The moisture holding capacity of air approximately doubles for every 27 per cent. rise in temperature, or, in other words, the relative humidity of air is halved when its temperature is raised 27°F. Christie, Ibid. p. 25.

§ Loc. cit. p. 12, &c.

|| Loc. cit. p. 24.

¶ Ibid. p. 40.

(2) *Parallel Current*.—Opposite of the foregoing, the fruit entering at the highest temperature and finishing at the lowest.

(3) *Combination System*.—Maximum temperature maintained at the centre. The fruit enters at a moderate temperature, passes through the highest temperature, whilst only partially dried, and finishes at a lower temperature.

(4) *Constant temperature* throughout the drying period.

The counter current is most common, being well suited to tunnel de-hydrators. The parallel current has not proved suitable. The combination type is satisfactory, and is applied in some large plants, as is also the constant-temperature type.

Fans or blowers of various types are used; for large plants, multivane fans seem to be best suited. The position of the fan also varies. It may either be so placed as to blow the air through the drying chamber under slight pressure, or else to draw the air through the chamber under slightly reduced pressure.

Re-circulation has already been briefly referred to. It consists in the return to the heating chamber, of a certain proportion of moist air that has already passed over the prunes. This, together with fresh air from outside, is heated and again blown over the prunes. The maintenance of a proper balance between the two is assured by manipulating the dampers for exhaust and intake, so as to keep the air humidity at the desired stage, this being checked by means of a wet- and dry-bulb thermometer. "Practical experience has shown that partial re-circulation decreases fuel consumption at least 50 per cent. without decrease in the rate of drying, and all commercially built de-hydrators now use this system."*

Until these facts are understood it seems paradoxical that though the drier the air the faster the evaporation from a free water surface, in the case of prunes, drying is actually facilitated and fuel saved if the air is not too dry.

Co-ordinating the Three Factors.—The proper co-ordinating of the three factors—temperature, humidity, and air circulation—is a matter demanding nice adjustment. According to Wiegand—"Temperature, humidity, and circulation are working in combination in removing the moisture from the fruit. . . . It is desirable that the evaporation be completed in the shortest time consistent with the best quality." . . .

It is seen that the problem of combining three variants is quite complicated. The range of temperature is from 100 deg. to 200 deg. F. circulation from 200 lineal feet per minute to 1,200 lineal feet per minute, and humidity from the natural to 40 per cent.

HEAT REQUIREMENTS AND HEATING SYSTEMS.

The quantity of heat, and consequently of fuel, needed to dry a ton of prunes varies according to the condition of the fruit and the efficiency of the drying plant.

According to Christie†—

For practical purposes, 1,100 B.T.U.‡ per pound of water evaporated may be taken as the basic requirement. This is made up of 90 B.T.U. to raise the temperature of each pound of water in the fruit from 60 deg. to 150 deg. F., and 1,010 B.T.U. to transform 1 lb. of water from the liquid to the vapour state at 150 deg. F. But various losses must be provided for—heat lost with the warm exhaust air that removes the water vapour; loss through the fruit entering the drier cold but leaving it hot; loss through the smoke stack that provides the draught; and losses through cracks in the buildings, doors, &c. Efficiently constructed and operated de-hydrators generally give an overall fuel efficiency

* Ibid. loc. cit. p. 27.

† Loc. cit. p. 18.

‡ By B.T.U. is understood British Thermal Units. Each such unit represents the amount of heat needed to raise the temperature of one pound of water one degree Fahrenheit.

very thorough, automatic control by means of a thermostatic steam valve being indeed possible. On the other hand, the cost of installation is high, and the air heating efficiency is not more than 50 or 60 per cent.

TIME REQUIREMENTS.

There is really a fourth factor—time. It takes a certain time for the internal moisture to find its way to the skin, where it is evaporated. Attempts to force the pace over-dry the outer layers before the moisture from within can reach them, and cause case-hardening. According to Christie*—

The time required to dry prunes may vary considerably, depending on the condition of the fruit as well as on conditions within the de-hydrator. The percentages of moisture and sugar before drying, the size of the prunes, the efficiency of dipping, and the amount of moisture remaining . . . all affect the drying time. The temperature, humidity, and volume of the air passing through the de-hydrator definitely affect the rate at which moisture is evacuated.

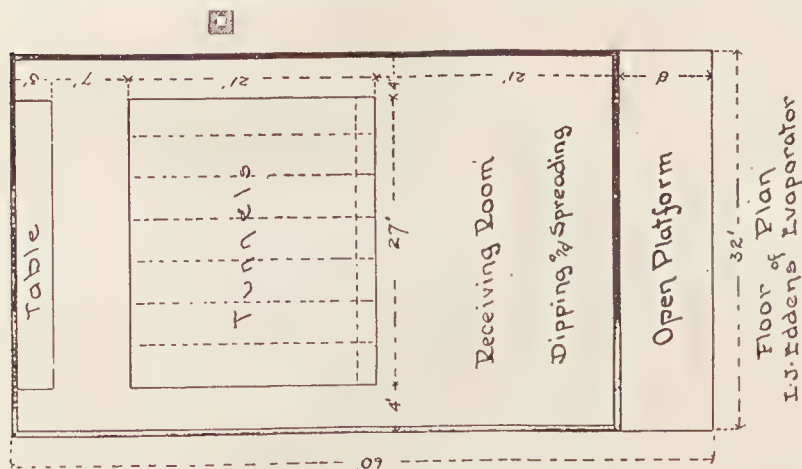


Fig. 7.—Floor plan of the L. J. Eddens' Evaporator (see Fig. 5).

Drying times ranging from 20 to 36 hours have been observed in all leading types of de-hydrators. In no case has a drying time of less than twenty hours been observed except where partly sun-dried prunes were finished in a de-hydrator. Large prunes counting 40 or less per pound after drying normally require 28 hours or longer, especially if high in sugar content. Taking as a representative average plump French prunes with a drying ratio of $2\frac{1}{2}$: 1 and counting 50 to 60 per pound when dry, the average time is found to be 24 hours.

MOISTURE CONTENT AFTER DRYING.

The exact point to which drying should be pushed, whether in the sun or in a de-hydrator, is not easy to determine; it is a matter demanding experience and nice judgment. We have seen that prunes must on no account be over-dried. They should be dry enough to keep well, but no more. It is certainly not a case of "the drier the better," enabling a given weight of prunes to "go further" when cooked. The reverse is indeed true, for it is a general though not an

* Loc. cit. p. 44.

invariable rule that the moister the prune, provided always that it is dry enough to keep, the higher the quality. The extra moisture does not, as some might think, merely "stretch" the fruit and make it weigh heavier; it really improves its quality. Allowances must also be made for the final processing, during which the prunes again absorb some of the moisture they have lost during drying.

According to Christie (p. 45)—

The proper moisture content . . . must remain a matter of judgment and experience, since there is unfortunately no simple, quick, and exact method for determining moisture in prunes. . . . When prunes are removed

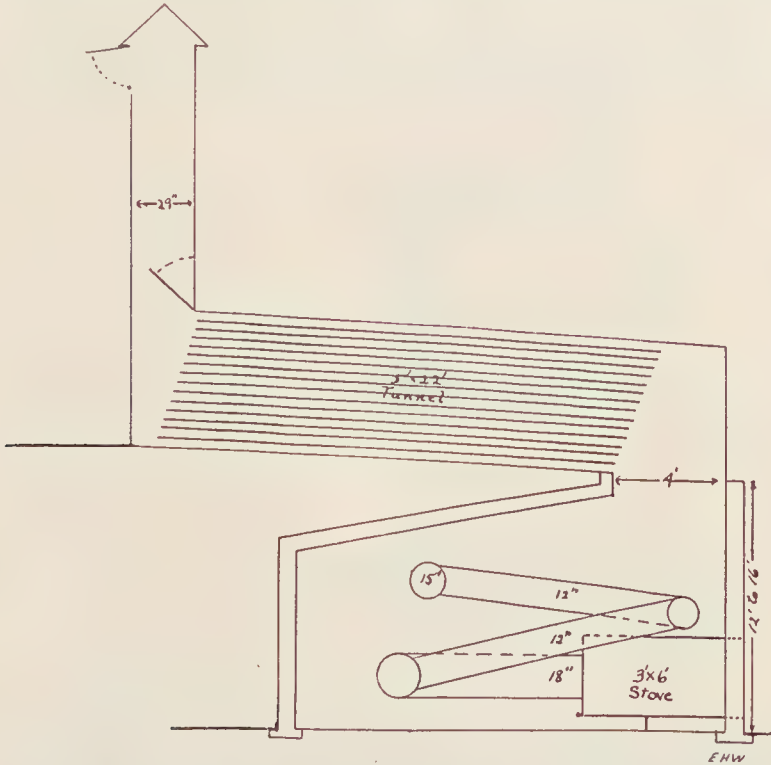


Fig. 8.—Diagram of Oregon Tunnel Drier or Evaporator. Air circulation by natural draught.

[Reproduced from Bulletin 205.—Drying Prunes in Oregon—Oregon Agricultural College.]

from a de-hydrator, they seem moister than they really are, because of the softening effect of the heat they still retain. Prunes which are case-hardened seem drier than they really are, and should be cut open and the flesh around the pit examined for its dryness. If prunes are so moist that the pit can be freely rolled around under the skin between the fingers, they are not sufficiently dried. The pit should be firmly held in the flesh. . . . Prunes containing in excess of 26 per cent. moisture will eventually mould. . . . In order that prunes may keep for a long period in bins, and to allow for the necessary absorption of moisture during hot-water processing, they should not be binned with a moisture content in excess of about 20 per cent. However, the safe moisture content varies somewhat with the size, variety, and sugar content of the prunes, and no exact moisture standard can or should be given at this time.

According to Wiegand*—

The common method of testing the fruit is to feel it to determine approximately what per cent. of moisture it contains; it should contain about 18 per cent. when removed from the drier. This is hard to determine, and many operators will be uncertain as to the right time for removing the fruit in the re-circulating drier, as it feels much more moist than fruit from a natural draught drier. Do not dry the fruit down too far, as it will become hard when cool. . . . The fruit can contain as high as 20 per cent. moisture.

(5) Bulking or Sweating.

Whether sun-dried or de-hydrated, there may be a good deal of variation in the condition, and more particularly in the moisture content, of freshly-dried prunes. Some may be too dry, others not dry enough. Case-hardening, in varying degrees, may also be in evidence. Storage for a couple of weeks in bulk remedies matters. Bins are provided for the purpose, in which the fruit is stored and allowed to remain before the final processing. The trays are usually scraped into sweat boxes, in which the fruit cools, and these are tipped into the bin; it is essential that the prunes should be cold before being bulked.

In Victorian practice sweating often takes place in sweat boxes, where the fruit remains about a fortnight. The prunes may need some attention during the process to ensure evenness, which may be promoted by occasionally transferring the contents of one sweat box to another.

The Dried Fruits Association of California, in its *Bulletin* No. 763, complains of prunes being delivered direct from the de-hydrator to the packing plant. It states: "The best practice requires that no de-hydrated prunes should be received at any packing plant until after such prunes have stood in the bin not less than ten days to two weeks, and have been allowed to pass through equalization."

Christie states that "It is well to turn the prunes after they have been in the bin for a week or two. If a layer of under-dried or mouldy prunes is revealed, they should be carefully removed to avoid mixing with the remaining prunes."

The general effects of sweating are to even-up the prunes to make them mellow and pliable instead of hard and uninviting, and to render the harsh skin soft and velvety.

(6) Final Grading.

After sweating and before packing, prunes often undergo a final processing, but before its execution grading is necessary; sometimes this is postponed until after the final processing, but more often it precedes it.

Even if the prunes were graded before drying, as is always desirable, this final grading is necessary, as all prunes do not dry alike, and some may become distorted or misshapen in drying. The preliminary grading, of course, simplifies the final one.

Prunes are graded according to size, based on the number that go to the pound. Size and quality are largely inter-dependent; it is the large and well-grown plums that dry into the best prunes (see p. 506).

* Re-circulation Driers, by Ernest H. Wiegand, Oregon Agricultural College, Experiment Station, Circular No. 40, p. 10.

Grade standards for Victorian prunes were proclaimed in the Fruit and Vegetables Packing Regulations 1930, the grades being mainly according to size. (See p. 687.)

In America, prunes are graded on somewhat similar lines.

Wiegand, in dealing with Oregon prunes, states*—

Sizing is done with screens, over which the prunes are shaken, ten or more sizes being recognized. . . . Prunes are packed according to size, the number of prunes in a pound designating the size, such as 20-30's, 30-40's, &c. In making the packed sizes the nine-point system is used. This involves the

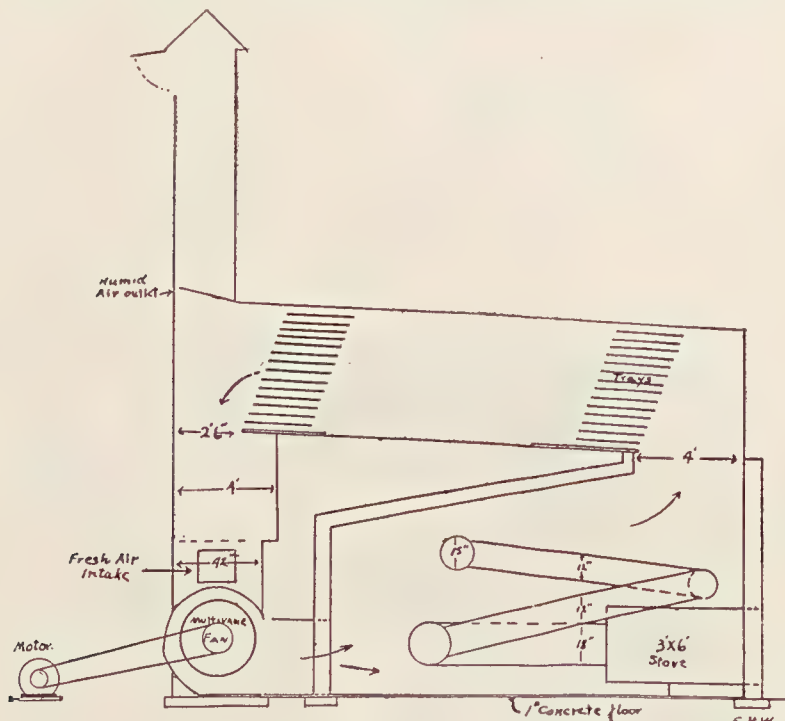


Fig. 9.—Diagram of Reconstructed Oregon Tunnel Dryer or De-hydrator, with mechanical draught and recirculating system.

[Reproduced from Bulletin 205.—Drying Prunes in Oregon—Oregon Agricultural College.]

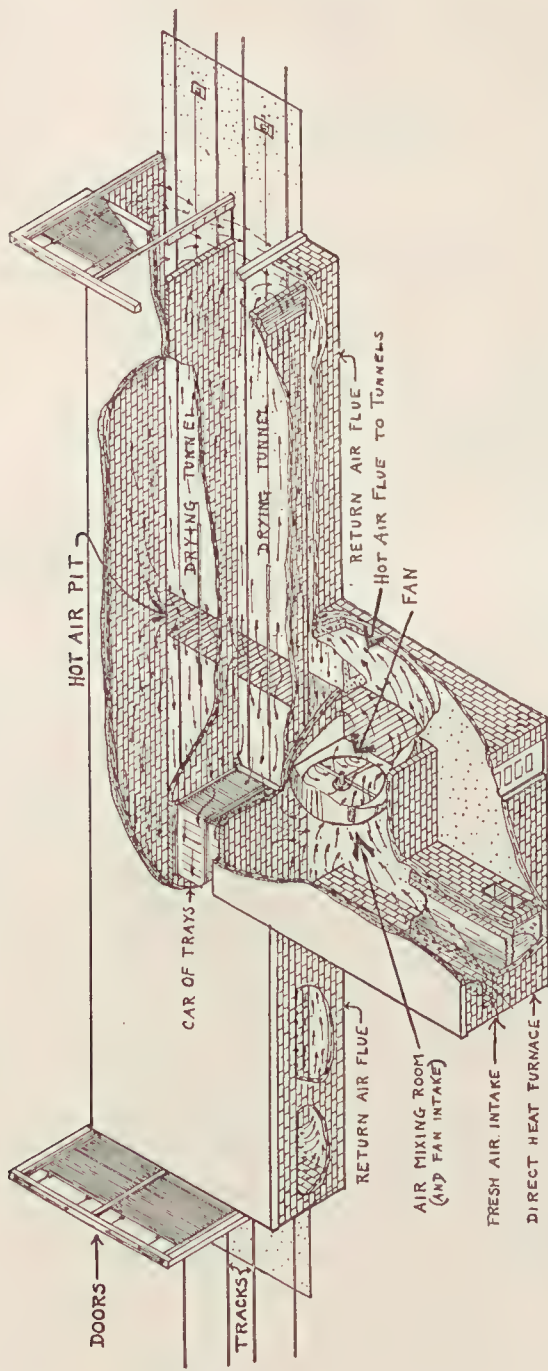
taking of two sizes, say, 30's and 40's, and mixing them, so that the 30-40's will run close to 39 a pound. Care must be taken to have moisture uniform and constant, otherwise a loss of a per cent. or two might cause the placing of a pack in the next size, with the resulting reduction in market value.

The removal of faulty and misshapen fruit, though of standard size, is desirable at this stage, though it can perhaps be more economically effected when the prunes are removed from the drying trays.

(7) Final Processing.

It is noteworthy that the best prunes, those of Agen, in France, are merely sweated and graded before packing; they need no other

* Oregon Agricultural College, Experiment Station, Bulletin 205, May 1924, p. 22.



[Fig. 10.—Diagrammatic sketch of a Two-tunnel "Chapman" De-hydrator.

[Reproduced from Bulletin 404.—The De-hydration of Prunes.—University of California.

treatment. Other prunes, however, usually undergo some special treatment in addition, concerning the need for which there is room for differences of opinion.

Methods sometimes used for finishing Victorian prunes seem to be of questionable utility. Had the drying and previous treatment been conducted on more judicious lines, there would be no reason for their application.

It is a mistake to over-dry a prune and endeavour to bring it back to fair condition, as is to often done here, by the final processing and by infusion in "dips" of various kinds, such as brine, syrup, weak glycerine, decoction of broken prunes and liquorice, either alone or in combination. The idea of using liquorice is no doubt to imitate the typical prune flavour, when, owing to faulty treatment, it has not developed naturally.

These finishing dips are on the whole undesirable. They make the prune sticky and unattractive, and the spurious, wet, clammy gloss given by glycerine and such substances is altogether different from the soft mellowness of the skin of a quality prune.

Nevertheless, these dips are still in use, and merit passing mention. A common formula is $\frac{1}{2}$ gallon of glycerine to 40 gallons of water. This is used at or near boiling temperature, the duration of immersion being a few seconds. The prunes are subsequently placed on the drying trays for two or three hours. Another formula is: water, 10 gallons; glycerine, $\frac{1}{2}$ pint; liquorice, 4 oz.

Mr. Woodham, of Renmark, recommends* a dip made of 12 lb. sugar and 2 lb. salt to 50 gallons water. The prunes are immersed in this at boiling temperature for one minute, then removed to trays until excessive moisture has dried off, and again put in sweat boxes.

In America, similar dips were formerly used, but they have been largely abandoned. One of these was a brine dip—about 5 lb. salt to 100 gallons of water. Liquorice, glucose, glycerine, or prune juice were sometimes added to make the prunes slimy. The proportion of glycerine seems to have been about 1 lb. to 20 gallons of water.

In Oregon, United States of America, prunes are usually finished nowadays either by hot water or steam; moisture absorption is more rapid and more considerable with the former. According to Wiegand†—

The latter seems to be the best method, as it is less cumbersome and sterilizes with the least amount of sugar loss. Hot water softens the prunes and causes more trouble in operating, as it is harder to avoid mushing and gumming the fruit.

The dried prunes are treated in a "processor," which may be either of the shaker or rotating drum type. The former seems more satisfactory, as the drum tends to make the fruit sticky and more ragged as the steam condenses, soaking and mashing the fruit.

As the fruit passes through the shaker type of processor, which is nothing more than a box open at both ends, it receives a spray of warm water at the start, then a minute or so of live steam at a high temperature, finally emerging heated to the pit. Sometimes, at the last, a hot-water spray is given, and then a final blast of dry steam.

Packing is done immediately; the fruit being hot, dries quickly, and while it is warm and a little damp when put in boxes, it does not necessarily gain or lose much weight. The fruit will gain in weight from nothing to 4 or 5 per cent., according to the condition it is in and the method of processing used.

* Murray Pioneer, 8th February, 1929.

† Drying Prunes in Oregon, p. 21, &c.

According to Creuss* the processing of dried prunes means immersing them in hot water for a period of two minutes or more in a processor which consists of a long metal tank filled with water heated to boiling, or nearly to boiling, by steam coils or open steam-jets, and of a conveyor equipped with perforated sheet-metal buckets. Processing cleanses the fruit, destroys all insect life, and renders the prunes pliable and of glossy appearance. The fruit increases in weight about 6 to 8 per cent. through absorption of water.

After the final processing the moisture content should not exceed 25 per cent. Christie states that prunes of a moisture content of 28.6 to 30.7 per cent. became mouldy, whereas those of 25 per cent. did not mould.†

(8) Packing and Marketing.

Packing is of vital importance; on it depend the preservation of the fruit in good order and its attractiveness to the consuming public. It is viewed somewhat differently from the producers' and from the retailers' stand-point. The latter should carry much weight, as it is the retailer who finally disposes of the fruit.

Australian prunes are usually packed in 56-lb. and 28-lb. cases, just as other dried fruits are. For quick local sale, in bulk, this form of package is convenient, cheap, and it has the sanction of long practice; but it provides inadequate protection against deterioration, infestation by fruit grubs is easy, and fruit is liable to damage from mould or to become too dry and hard.

It has been found in America that prunes packed, into . . . boxes, directly from the processor without drying or cooling, retain their high temperature for several hours if packed closely. Caramelization of the sugar may injure quality. Staggering of the boxes is recommended so that air currents may cause rapid cooling (Creuss).

Prunes, like raisins, are liable to damage by various grubs, mainly the larvæ of the Indian meal moth (*Plodia interpunctella*), the dried fruit beetle (*Carpophilus hemipterus*), and other some weevils. They are also liable to mould, much more so than raisins, in fact. A mould often seen on prunes has a fine white powdery appearance, quite different from the voluminous common moulds, only too familiar on fresh fruit, jams, &c., sometimes picturesquely referred to as "whiskers."

Some of our big grocery stores retail prunes in 1-lb. cartons, which they pack themselves from the 65-lb. case. The popular carton is a very suitable container used in this way. It is less satisfactory if packed and stored for any length of time, owing to its inadequate protection from grub infestation, from mould, and from undesirable dessication.

For overseas transport the ordinary case is not an ideal package, and we can take a hint from foreign competitors on our local market, who have mostly abandoned this form of package in favour of air-tight containers.

* Loc. cit. p. 424.

† Christie—Processing Dehydrated Prunes, 1927.

Some years ago, both American and French prunes, mainly in the cheaper grades, were landed here fairly extensively in cases. The condition was often faulty. To-day, American prunes are chiefly imported in tins of 1 lb. and 5 lb. They are hermetically sealed, just as jam is. Packed in this way, hot from the final processing (see p. 682), neither grubs nor moulds need be feared, and they open up in excellent condition in any climate.

According to Creuss* they are often packed scalding hot in cans, and sealed under a high vacuum . . . they preserve their original glossy appearance and soft texture, and do not undergo sugaring. They are also packed hot into cans and exhausted in live steam for fifteen minutes before sealing. Unless vacuum-sealed or thoroughly exhausted before sealing, corrosion and perforation of the tin-plate are very common, and spoilage losses from these sources are heavy.

French prunes are now mainly imported in glass jars and in 7 and 14 lb. tins. With few exceptions, they are not hermetically closed. The jars have a screw top, sealed only with a gummed paper strip, and the tins have "push-on" lids. It is curious that, notwithstanding this rather inadequate seal and a high-moisture content, French prunes keep very well. The freedom from mould is, in fact, remarkable, and the reason for it not clear. Australian prunes similarly packed in jars often become mouldy after a few months' storage, whereas the French keep for many months in sound condition. One of Melbourne's large importers of French prunes informed the writer that he can recollect only one season in which mould showed itself on French prunes. The crop that year was a light one, and the prunes were large—30's to 32's—and juicy.

Defects and their Causes.

The most common defect in prunes is due to insufficient maturity when picked. A good prune cannot be dried from immature fruit. Faulty prunes from this cause lack sugar and substance, and are little more than pit and skin. They do not swell to any extent when cooked, are unpalatable, and prejudice the public against this most wholesome fruit.

Lack of size and substance, or pulp deficiency, may be due to other causes, such as bad orchard practice—injudicious pruning, inadequate tillage, faulty irrigation, and insufficient manuring. Over-production is always injurious to quality, and trees should not bear more fruit than they can bring to perfection (see p. 506). The yield should be kept within reasonable bounds by pruning, and, if still too heavy, by deliberate thinning when the fruit is still small.

Excessive skin thickness is sometimes a defect of prunes grown under the dry atmospheric conditions of northern Victoria. French prunes have a much thinner skin; they are grown in a cooler climate, with more humid atmosphere and higher rainfall than ours. Fortunately, lye dipping permits the correction of this natural defect to a large extent.

Over-drying is a common fault, especially with sun-dried prunes. The final processing is then relied on for reconditioning and bringing

* *Loc. cit.* p. 423.

back the over-dried fruit to a more suitable moisture-content. This "processing back" is never satisfactory; it altogether fails to restore it to the condition it would have had if drying had ceased at the proper moment.

Lack of the typical prune flavour is a serious defect that may be due to a variety of causes—to drying from the wrong sort of plum or from plums that have not been properly grown and ripened. It also results from faulty drying methods. This desirable flavour is more pronounced in artificially-dried than in sun-dried prunes, and reaches its greatest perfection in the French Agen prune. It is not clear whether this is mainly due to climatic conditions and the sort of plum grown, or to the special drying method as described below.

In America, several picturesque and expressive terms are used to describe faulty prunes. The following are those most frequently met with:—"Dobie's" are prunes which dry more slowly than most of the fruit on the tray, and have to be redried. "Bloaters" are prunes which puff up until the skin becomes very tight, so that they often explode and are worthless . . . nothing but skin and pit. They are apt to have a burned or scorched flavour. "Frogs" are cured prunes which are very much misshapen, probably owing to the fruit being unripe. "Chocolates" are prunes the skin of which was sufficiently checked owing to the lye being too weak or cold, and which have in consequence failed to dry sufficiently.* Other defects occasionally complained of in the United States of America are "slugs," "splits," "broken" and "bruised" fruit, and fruit with scab.

Bloaters, Frogs, and Chocolates.—These are the results either of insufficient dipping or of immaturity, over-ripeness, or partial decay of the prunes.

Grade Standards for Victorian Prunes.

These are set out as follows in the Fifth Schedule of the Fruit and Vegetables Packing Regulations 1930:—

In addition to compliance with the general requirements of these Regulations, dried prunes contained in a package shall be divided into either one or other of eight grades, viz.:—"20-30," "30-40," "40-50," "50-60," "60-70," "70-80," "80-90," and "Small," and shall be graded and packed in accordance with the following provisions:—

- (a) the package shall be marked with a true designation of the grade, whether "20-30," "30-40," "40-50," "50-60," "60-70," "70-80," "80-90," or "Small," of the dried prunes contained in the package;
- (b) each external layer of dried prunes on the top, bottom, and sides of the dried prunes shall be a true indication of the average grade of the dried prunes throughout the package;
- (c) dried prunes in each grade shall be of such a size that the number of fruit in 1 lb. weight shall be not less than the smaller number nor more than the larger number in the name of the particular grade shown on the package; excepting that in the case of "Small" grade the number of fruit in 1 lb. weight shall be over 90; and provided also that a total margin of not more than 5 per cent. by count shall be allowed in each grade of fruits from the grade immediately below and above such grade.

(To be continued.)

* Hendrickson—Prune Growing in California, p. 34.

LONGERENONG AGRICULTURAL COLLEGE.

EXPERIMENTAL WORK.

In 1907 a wheat breeding station was established by the Department of Agriculture, in co-operation with the Council of Agricultural Education, at Longereng College, Doon. In 1912 the work was revised and a series of permanent experimental plots laid out. The work has been extended from time to time to include yield trials of varieties, permanent manurial tests, permanent rotation tests, and a comprehensive series of cultivation trials.

During the past twenty years the yields in the County of Borung, taking five-year periods, have increased from 8 bushels to 25 bushels per acre, and at the same time land values have more than trebled. The investigational work at Longereng has been of material assistance to the Department in its efforts to increase the wheat yield. This year the usual experimental work has been supplemented by research into the basic principle underlying the practice of bare fallowing, more particularly in respect to the conservation of moisture and of nitrogen.

RAINFALL REGISTERED AT EXPERIMENT PLOTS.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total Points.
1925	43	56	22	54	298	140	103	86	190	21	104	11	1,128
1926	17	18	24	200	306	188	214	197	121	154	13	40	1,492
1927	18	38	42	2	164	80	168	177	85	58	75	111	1,018
1928	200	329	143	81	74	203	132	21	172	245	..	11	1,611
1929	79	109	171	66	107	157	100	113	71	110	28	266	1,374
1930	Nil	123	5	110	79	17	211	207	101	295	..	..	..

Section 1.—Variety Plots.

Area of Plots ..	..	Quarter acre.
Rate of Seeding ..	..	70 lb. per acre.
Pickling ..	..	Copper carbonate, 2 oz. per bushel.
Manure ..	..	Superphosphate, 1½ cwt.
Sown ..	..	10th and 14th July.

In this section the leading varieties and most promising crossbreds are shown. The seed harvested from this field is sown in larger areas on the College farm for bulk distribution to farmers, and is also distributed to other experimental fields in the State. The following table summarizes results for the past six years.

TABLE I.—WHEAT VARIETY TESTS.

Showing yield in bushels per acre.

Variety.	Average Yields.		Yield 1929.
	Six Years 1924-29.	Three Years 1927-29.	
Nizam	33.4	22.1	20.7
Rancee	33.4	24.3	19.4
Free Gallipoli	33.1	22.2	14.2
Federation	32.7	20.3	13.5
Wannon	31.1	19.3	15.4
Ghurka	..	24.0	17.8
Mogul	..	23.1	18.7
Merredin	..	22.9	19.4
Nabawa	..	22.5	13.7
Wandilla	..	21.2	13.9
Rajah	..	..	22.9
Waratah	..	..	14.3
Canberra x Hard Federation	..	..	12.4
Gallipoli x Graham ..	..	..	9.7

Section 2.—Wheat Variety Tests (Replicated).

In 1927 it was decided that the most promising wheat varieties should be compared by the most accurate means available in order to eliminate all but the highest yielding types.

Under the method adopted, the varieties are being compared in pairs side by side, each pair being repeated four times and each plot being halved subsequently. By this system it is hoped to get results accurate to within 2 or 3 per cent.

In future no variety will be named or released if it does not give yields superior to the standard varieties over at least three years on a test arranged as above. This year seven varieties have been grown in 56 plots, each of which will be halved prior to harvest, thus making 112 plots. This provides eight plots of each variety, each being next to a check plot of Federation, and the whole series so arranged that any non-conformity in natural conditions will be felt equally by the variety and its check plot.

The system adopted also permits of the degree of accuracy of each comparison of varieties being ascertained; thus the results may be accepted or rejected according as to whether they are regarded as significant or not.

SOWING DATA FOR 1930.

Area of Plot ..	..	One-fortieth acre.
Rate of Seeding ..	..	70 lb. per acre.
Pickling ..	..	Copper carbonate, 2 oz. per bushel.
Manure ..	..	Superphosphate, 1½ cwt. per acre.
Sown ..	..	16th and 17th July.

TABLE 2.—REPLICATION TRIALS WITH WHEAT, 1927–28–29.

Average yields in bushels per acre of 8 plots sown to each variety.

	1927.	1928.	1929.		1927.	1928.	1929.
Nizam	28·0	26·2	18·2	Canb. x Hd. Fedn. ..	..	28·4	18·1
Federation ..	26·3	23·0	15·9	Federation	..	25·7	16·6
Increase over {bus./ac.	1·7	3·2	2·3	Increase over {bus./ac.	..	2·7	1·5
Federation { %	6%	14%	14%	Federation { %	..	10%	9%
Mogul	23·7	28·6	20·8	Gall. x Graham ..	..	27·3	14·7
Federation ..	22·7	24·2	18·7	Federation	..	25·1	17·3
Increase over {bus./ac.	1·0	4·4	2·1	Increase over {bus./ac.	..	2·2	—2·6
Federation { %	4%	18%	11%	Federation { %	..	9%	—15%
Free Gallipoli ..	23·1	31·4	19·7	Ind. F. x Fedn. x Wan-			
Federation ..	22·4	26·8	18·3	non	..	21·9	..
Increase over {bus./ac.	0·7	4·6	1·4	Federation	..	22·3	..
Federation { %	3%	17%	8%	Increase over {bus./ac.	..	—0·4	..
Ghurka	24·1	26·3	19·4	Federation { %	..	—2%	..
Federation ..	23·6	22·0	18·9	Curr. x Maj. x Gall. ..	..	24·4	..
Increase over {bus./ac.	0·5	4·3	0·5	Federation	..	26·2	..
Federation { %	2%	20%	3%	Increase over {bus./ac.	..	—1·8	..
Wannon	25·9	25·6	18·5	Federation { %	..	—7%	..
Federation ..	22·1	25·2	18·6	Minister x Federation	..	22·7	..
Increase over {bus./ac.	3·8	0·4	—0·1	Federation	..	24·6	..
Federation { %	17%	2%	1%	Increase over {bus./ac.	..	—1·9	..
				Federation { %	..	—8%	..

Section 3.—Intermediate Variety Wheat Plots.

In these plots new fixed crossbreds and standard wheats are grown for the sole purpose of providing a convenient bulk of pure seed to work with. They are of such a size as to be easily subjected to continual critical inspection prior to harvesting for the detection of strange varieties or characteristics not true to type.

STUD ROWS.

There are 675 stud rows, each being 1 chain in length and each sown by hand. The grains are between 4 and 5 inches apart. Rows 1 to 54 are sown with oats, 55 to 65 with barley, and the remainder with wheat. Some rows are devoted to maintaining a supply of pure seed of already established varieties, while the remainder are sown with unfixed crossbreds. The latter are inspected before harvest, the estimated yield compared with check plots of Federation for uniformity of type, length of straw, period of maturity and absence of obnoxious features. Promising rows are cut and threshed by hand, the seed obtained furnishing seed for the Intermediate plots the succeeding season.

Section 4.—Oat Variety Plots.

Area	..	..	One-thirtieth acre.
Manure	..	..	Superphosphate, 1 cwt. per acre.
Seed	..	..	60 lb. per acre (unpickled).
Sown	..	..	3rd June on bare fallow.

Although Longerenong cannot be regarded as a district well suited to the growth of oats, this cereal, when grown on well-worked fallow, has proved a safe crop in the droughty years prevailing since 1926. During this time, however, oats on stubble have been a comparative failure. A study of the following table will show several varieties which have given good yields during the period mentioned, and which are very suitable for hay making.

A promising variety for early grain is Palestine, ripening from 10 to 14 days earlier than Algerian. It is a short-strawed variety, hence unsuitable for hay. It has a plump grain resembling Algerian.

Very tall-growing, heavily flagged varieties similar to Earl Haig have been grown successfully here but only with irrigation.

Owing to failure of the oat crop for 1929, results for that year are not available.

TABLE 3.—YIELDS OF OAT VARIETIES, 1926-27-28.

Variety.					Yield bushel 1928.	Average Yield 1926-27-28.	Average Yield. 1927-28.
Algerian	..	..	..	..	55.4	46.0	40.8
Palestine	..	..	..	..	58.5	44.7	46.8
Lachlan	..	..	..	..	48.7	44.6	36.8
Mulga ..	..	..	..	..	54.0	..	42.1
Burts Early	..	..	..	..	24.5	..	18.5
Earl Haig	..	..	..	..	20.1	..	11.4
Sunrise	..	..	..	..	41.5	..	..

Section 5.—Cultivation Tests.

These plots have been designed to furnish information as to the best methods of cultivation. This test affords a comparison of the efficiency of principal systems of fallowing employed by Wimmera farmers. The experiment was inaugurated in 1926, when twenty quarter-acre plots on a uniform piece of land were fallowed in various ways. The boundary of each plot is indicated by a white peg bearing the number of the plot. The plots were sown with Federation at the rate of 75 lb. per acre, and in 1927 gave yields ranging from 3.5 bushels to 34.7 bushels per acre, the best yields being obtained on summer fallow plots, the crops on which averaged 10 bushels per acre more than those on winter fallow. In the succeeding year, however, the crops on summer fallow, although exhibiting a slightly more vigorous growth in early spring, were not able to maintain their advantage and at harvest averaged 1.2 bushels less than those plots sown on winter fallow.

The results so far obtained have been inconclusive, and the experiment will have to be continued for some years before the data can be properly interpreted.

TABLE 4.—CULTIVATION TESTS. RESULTS FOR 1927-28-29.

Plot.	Treatment.	Bushels per Acre.		
		Yield 1929.	Average for Two Years 1928-29.	Average for Three Years 1927-28-29.
	<i>Summer Fallow—</i>			
1	March. Ploughed 3½ in. deep, scarified end July, 3½ in., worked standard manner	22.1	25.7	27.8
2	March. Ploughed 5 in. deep, scarified end July, 3½ in., worked standard manner	20.0	24.9	26.6
3	July (check). Ploughed 3½ in., scarified end August, 2½ in., worked standard manner	18.2	20.6	
4	March (check). Ploughed 3½ in., scarified end July, 3½ in., worked standard manner	24.7	27.4	
5	March. Scarified 3½ in., scarified end July, 3½ in., worked standard manner	25.7	28.0	
6	March. Spring-toothed 2 in. deep, ploughed end July, 3½ in., worked standard manner	24.0	27.5	29.1
7	March. Ploughed 3½ in., scarified end July, 2½ in., worked standard manner	25.8	27.7	28.8
8	March (check). Ploughed 3½ in., scarified end July, 3½ in., worked standard manner	25.8	28.0	
9	March. Ploughed 5 in., scarified end July, 3½ in., worked to maintain 3½ in. mulch	24.0	26.7	
10	May. Ploughed 3½ in., scarified end July, 3½ in., worked standard manner	22.4	26.4	28.1
	<i>Winter Fallow—</i>			
11	July (check). Ploughed 3½ in., scarified August, 2½ in., worked standard manner	20.0	26.3	24.7
12	July. Ploughed 3½ in., scarified August, 3½ in., maintain 3½ in. mulch	20.4	25.8	24.5
13	July. Ploughed 5 in., scarified August, 3½ in., maintain 3½ in. mulch	19.8	25.6	
14	March (check). Ploughed 3½ in., scarified end July, 3½ in., worked standard manner	21.5	24.9	
15	July (check). Ploughed 3½ in., scarified August, 2½ in., worked standard manner	20.4	26.0	
16	July. Ploughed 3½ in., scarified August, 2½ in., worked standard manner, but knife-barred dry in January	21.8	26.4	25.4
17	July. Ploughed 3½ in., scarified August, 2½ in., worked in standard manner, but disced dry in January	18.4	23.9	23.1
18	October. Ploughed 3½ in., scarified November, 2½ in., worked in standard manner	16.0	19.0	19.3
19	June. Ploughed 3½ in., just prior to seeding, non-fallow	8.2	10.2	8.0
20	July. Ploughed 3½ in., scarified August, 2½ in., not cultivated after, merely sheeped till seed time	18.0	17.0	14.0

TABLE 5.—SHOWING DETAILS OF CULTIVATION FOR PLOTS SOWN 1930, AND OF FALLOWED SECTION FOR 1931 SEEDING.

Cultivation Tests.

Fallowed Section for 1930 Seeding. Treatment of each plot is indicated on labels placed in front of each division.

Summer Fallow—

1. March. Ploughed $3\frac{1}{2}$ in., scarified end July, $3\frac{1}{2}$ in., worked standard manner.
2. March. Ploughed 5 in. deep, scarified end July, $3\frac{1}{2}$ in., worked standard manner.
3. July (check). Ploughed $3\frac{1}{2}$ in., scarified August, $2\frac{1}{2}$ in., worked standard manner.
4. March (check). Ploughed $3\frac{1}{2}$ in., scarified end July, $3\frac{1}{2}$ in., worked standard manner.
5. March. Scarified $3\frac{1}{2}$ in., scarified end July, $3\frac{1}{2}$ in., worked standard manner.
6. Springtoothed 2 in. deep. Ploughed end July, $3\frac{1}{2}$ in., worked standard manner.
7. March. Ploughed $3\frac{1}{2}$ in., scarified end July, $3\frac{1}{2}$ in., worked to maintain $3\frac{1}{2}$ in. mulch.
8. March (check). Ploughed $3\frac{1}{2}$ in., scarified end July, $3\frac{1}{2}$ in., worked standard manner.
9. March. Ploughed 5 in., scarified end July, $3\frac{1}{2}$ in., worked to maintain $3\frac{1}{2}$ in. mulch.
10. May. Ploughed $3\frac{1}{2}$ in., scarified end July, $3\frac{1}{2}$ in., worked standard manner.

Winter Fallow—

11. July (check). Ploughed $3\frac{1}{2}$ in. deep, scarified August, $2\frac{1}{2}$ in., worked standard manner.
12. July. Ploughed $3\frac{1}{2}$ in., scarified August, $3\frac{1}{2}$ in., maintain $3\frac{1}{2}$ in. mulch.
13. July. Ploughed 5 in., scarified August, $3\frac{1}{2}$ in., maintain $3\frac{1}{2}$ in. mulch.
14. March (check). Ploughed $3\frac{1}{2}$ in., scarified end July $3\frac{1}{2}$ in., worked standard manner.
15. July (check). Ploughed $3\frac{1}{2}$ in., scarified August, $2\frac{1}{2}$ in., worked standard manner.
16. July. Ploughed $3\frac{1}{2}$ in., scarified August, $2\frac{1}{2}$ in., worked in standard manner, but knife-barred dry in January.
17. July. Ploughed $3\frac{1}{2}$ in., scarified August, $2\frac{1}{2}$ in., worked in standard manner, but disced deeply dry in January.

Non-fallow and Late Fallow—

18. October. Ploughed $3\frac{1}{2}$ in., scarified November $2\frac{1}{2}$ in., worked in standard manner.
19. June. Ploughed $3\frac{1}{2}$ in., just prior to seeding, non-fallow.
20. July. Ploughed $3\frac{1}{2}$ in., scarified August $2\frac{1}{2}$ in., then not cultivated, but merely sheeped till seed time.

Standard Treatment is as follows:—Sheeped during spring. Scarified 2½ in. deep to kill weeds in August and September. Subsequently worked with spring-toothed cultivator or harrows after rain to kill weeds, maintain a 2½-in. mulch and level consolidated seed bed. Scarified and harrowed twice before sowing.

Seed sown at rate of 70 lb. per acre.

Manure: 1½ cwt. superphosphate, 22 per cent.

Pickle: Copper carbonate, 2 oz. per bushel.

Section 6.—Manurial Trials.

Area	..	..	..	..	One-twelfth acre each
Federation wheat	..	..	..	..	80 lb. per acre.
Copper carbonate pickled	..	..	..	..	2 oz. per bushel.
Manures	..	..		..	As shown on labels.

The object of this test is to determine how much superphosphate should be applied to obtain the maximum profit per acre. Experiments here, as elsewhere, show that on most soils there is a steady and proportionate increase in the yield as the amount of manure applied is increased, until a point is reached after which the same ratio is not maintained. Eventually there is no response to further dressings. Obviously, then, it is desirable to determine the manurial dressings giving the greatest net profit, and this is not necessarily that which gives the highest yield, as the cost of the excess manure may exceed the value of the additional grain produced.

TABLE 6.—MANURIAL TRIALS.

Showing average yield for the last 18 years in bushels per acre.

Manurial Treatment.	Yield 1929.	Average Yield, 18 Years, 1912-1929.
No Manure	21·0	31·8
Super., ½ cwt. per acre	21·6	35·3
Super., 1 cwt. per acre	21·0	36·5
Super., 2 cwt. per acre	19·4	37·8
Super., 1 cwt. + lime 5 cwt. per acre	22·0	36·3
Super., 1 cwt. + lime 10 cwt. per acre	22·2	35·6
Super., 1 cwt. + Nitrate of Soda 40 lb. with seed	21·4	35·9
No manure	21·0	31·0
Basic Slag, 1 cwt. per acre	19·4	32·5
Super., 1 cwt.	21·2	36·1
Super., 1 cwt. Nit. of Soda, 40 lb. Pot. Sulph., 40 lb.	21·0	36·0
Super., ½ cwt. + Basic Slag ½ cwt.	20·2	35·1
Super., 1 cwt. + Nit. of Soda, 40 lb. in Spring	21·4	36·1
Farmyard Manure, 10 tons per acre	21·2	33·7
No Manure	20·0	32·7

Average of the three No Manure Plots is 31·8 bushels per acre.

Average of the two Super., 1 cwt. Plots is 36·3 bushels per acre.

TABLE 7.—PROFIT PER ACRE DUE TO SUPERPHOSPHATE.

Treatment.	18 Years Average Yield in per Acre Bushels 1912-29.	Increase over No Manure in Bushels.	Cost of Super. at— 5s. 6d. per cwt.	Value of Increase at—		
				3s. per Bus.	4s. per Bus.	5s. per Bus.
			<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
No manure	31·8	..	..	..	..	..
Super., $\frac{1}{2}$ cwt. per acre	35·3	3·5	2 9	7 9	11 3	14 9
Super., 1 cwt. per acre	36·3	4·5	5 6	8 0	12 6	17 0
Super., 2 cwt. per acre	37·8	6·0	11 0	7 0	13 0	19 0

Section 7.—Manurial Trials with Triple Superphosphate.

Area of plot One-twelfth acre.

Federation wheat .. Sown at rate of 70 lb. per acre.

Manures As shown on labels.

Triple superphosphate contains 48 per cent. of phosphoric acid, hence 51 $\frac{1}{2}$ lb. of it contains as much phosphoric acid as one cwt. of 22 per cent. superphosphate.

TABLE 8.—MANURIAL TRIALS WITH TRIPLE SUPERPHOSPHATE.

Showing yield in bushels per acre.

Plots.	Yield for 1929 only.
No Manure	22·0
Triple Super., equivalent to 1 cwt. of Super. per acre	20·2
Super., 1 cwt.	21·4
Triple Super., equivalent to 2 cwt. of Super. per acre	19·8
Super., 2 cwt.	20·4
Triple Super., equivalent to 1 cwt. of Super. per acre	19·8
Super., 1 cwt.	22·8
No Manure	19·4

TABLE 9.—AVERAGE YIELD FOR PAST SIX YEARS.

Treatment.	Average Yield 1924-29.
No Manure	29·8
Super., 1 cwt. per acre	34·1
Super., 2 cwt. per acre	34·5
Triple Super., equivalent to Super., 1 cwt.	34·2
Triple Super., equivalent to Super., 2 cwt.	34·3

NOTE.—18 per cent. superphosphate used in 1924-25; 22 per cent. superphosphate used after 1925.

There is, over a period of six years, no significant difference in the yields obtained by using 22 per cent. super. and triple super. (48 per cent. phosphoric acid). An advantage that could be gained by using triple super. is a reduction in freight charges and general convenience in handling, as the bulk of triple super. required to contain the same amount of phosphoric acid as that in 22 per cent. super. would be less than half of the 22 per cent. super.

Residual Effect of Fertilisers.

In 1927, 1928, and 1929 oats were sown on the site of the preceding year's manurial wheat plots. The object of so doing was to determine the effect, if any, that the manure applied to the wheat crop had on the succeeding oat crop.

Owing to the dry seasons the growth of oats was too poor and sparse to give a reliable result. At the time of writing, however, there is promise of getting a more or less significant result this year. A further series of oats sown on stubble and treated at seeding time with phosphatic and nitrogenous fertilizers have not given significant results during the past two seasons.

Section 8.—Rate of Seeding and Spacing Tests.

Area	..	..	One-thirtieth acre.
Pickling	..	..	Copper carbonate, 2 oz. per bushel.
Manure	..	..	Superphosphate, 1½ cwt. per acre.
All plots	..	..	Sown with a 12-hoe combine.
Spacings	..	..	3½-inch and 7-inch rows.

TABLE 10.—RESULTS OF RATE OF SEEDING AND SPACING FOR FIVE YEARS, 1925-29.

Rate of Seeding			3½-in. Spacing. Average Yield in Bushels, per Acre.	7-in. Spacing. Average Yield in Bushels, per Acre.
45 lb. of Federation per acre	..	..	34.8	34.8
60 lb. of Federation per acre	..	..	35.1	36.7
75 lb. of Federation per acre	..	..	35.3	35.1
90 lb. of Federation per acre	..	..	35.5	36.3
Average	..	..	35.2	35.7

Since this table represents results obtained over five seasons only, it is not permissible to draw absolutely definite conclusions from the data. The results are neither definitely nor uniformly in favour of either the two spacings considered, and at present, therefore, furnish no reason for departing from the recognized practice of sowing in rows 7 inches apart.

TABLE 11.—TIME AND RATE OF SEEDING FOR FIVE YEARS, 1925-1929, IN BUSHEL PER ACRE.

Rate of Seeding. per Acre.		Spacing.	Yield 1929, Bushels per Acre.		Average Yields 1925-29.		
			Early Sown.	Late Sown.	Early Sown.	Late Sown.	Difference in Favour Early Sown.
45 lb.	.. {	3½ inches ..	29.7	16.6	38.6	31.1	7.3
		7 inches ..	27.9	19.8	38.4	31.1	7.3
60 lb.	.. {	3½ inches ..	25.2	18.0	38.6	31.5	7.1
		7 inches ..	28.9	18.9	40.3	33.0	7.3
75 lb.	.. {	3½ inches ..	25.7	20.7	38.4	32.3	6.1
		7 inches ..	27.0	18.4	39.0	31.3	7.7
90 lb.	.. {	3½ inches ..	27.4	18.9	38.4	32.6	5.8
		7 inches ..	29.2	19.3	39.9	32.7	7.2

A study of the above table shows that for the period 1925-1929 early sowing has proved much more profitable than late sowing, whereas a perusal of the table following will show that for the ten years 1915-1924 the opposite was the case. The reasons for this sudden and consistent reversal are not definitely known and may possibly be related to the dry spring weather experienced in recent years, or to changed cultural practices at Longerenong.

Earlier and more skilful cultivation has reduced the total weed growth on fallows, and has resulted in an earlier germination of rubbish—thus partly doing away with the necessity for very late seeding.

TABLE 12.—TIME AND RATE OF SEEDING.

Average over period of ten years, 1915-1924 (inclusive).

Federation Wheat	Pounds of Seed per Acre.				
	45.	60.	75.	90.	120.
	bushel.	bushel.	bushel.	bushel.	bushel.
Early sowing	39.8	42.3	43.8	41.7	41.8
Late sowing	45.0	45.5	48.5	48.6	47.6
Difference in favour of late sowing ..	5.2	3.2	5.0	6.9	5.8

The above table shows the marked superiority of late sowing during the period 1915-1924.

In the north-western Wimmera it has been proved that early-sown crops are superior to late-sown ones.

At Longerenong 75-80 lb. of seed per acre is the most profitable application in normal seasons.

Section 9.—Wheat in Furrow Tests.

It has been suggested that, in dry districts, particularly the Mallee, if wheat were sown in furrows running at right angles to the direction of the prevailing winds, the concentration of moisture in the furrow, due to drainage from the slopes, and the subsequent protection afforded the roots and base of the young plant by the ridged earth, would produce bigger yields than those from land sown in the ordinary way.

In addition, wider spacing of the rows, to facilitate the ridging practice and give each individual plant more root range, would, it was considered, aid in attaining the above desired result.

To test these theories, a series of 24 small replicated plots was arranged and sown by hand at Longerenong.

There are eight each of the following types of plots:—

Flat sown in rows 7 inches apart.

Flat sown in rows 9 inches apart.

Sown in furrows 9 inches apart—Furrows running north-east and south-west.

Section 11.—Pastures.

Wimmera rye grass, as the name implies, has proved itself suitable as a pasture in this district. It is, however, not absolutely uniform in type, and efforts have been made to select and propagate, from natural variants, better and more profitable strains.

A new strain is this year being grown, that common to the locality acting as a check.

In addition, plots are sown to four strains of subterranean clover, to Bokhara, Sulla, and Berseem clovers, to tick beans and to silver beet. The subterranean clovers gave only a moderate germination, and subsequent growth has been very slow; it is practically at a standstill.

The rye grass was sown at rate of 15 lb. per acre; the subterranean clover at rate of 4 lb. per acre. Manure was applied at rate of 1 cwt. per acre; the seed and manure were mixed just before seeding.

Section 12.—Permanent Rotation Tests.

These are situated on the north side of the avenue. Eight systems are undergoing trial side by side.

Series A.—Wheat continuously.

Series B.—Wheat after bare fallow.

Series C.—Wheat, pasture, bare fallow.

Series D.—Wheat, barley, peas.

Series E.—Wheat, oats, peas.

Series F.—Wheat, oats, bare fallow.

Series G.—Wheat, oats, pasture, bare fallow.

Series H.—Wheat, rape, barley, peas.

TABLE 15.—AVERAGE YIELD OF WHEAT GROWN UNDER VARYING SYSTEMS OF CROP ROTATION FOR TWELVE YEARS, 1918–1929.

Crop Rotation.	Yield for 1929 Bushels per Acre.	Average Yield for Twelve Years 1918–29.
A. Wheat continuously	8.5	8.8
B. Wheat after bare fallow	15.5	31.8
C. Wheat, pasture, bare fallow	18.3	33.0
D. Wheat, barley, peas	0.3	24.3
E. Wheat, oats, peas	0.2	24.1
F. Wheat, oats, bare fallow	14.0	34.1
G. Wheat, oats, pasture, bare fallow	16.5	33.5
H. Cheat, rape, barley, peas	0.4	26.6

The highest yields are always preceded by a bare fallow. In 1927 the plots not grown on bare fallow were a complete failure.

As a rule, peas thrive well, but depress the wheat yield by an average of 10 bushels per acre.

Rape has never been a profitable crop.

The comparative failure of the rape crop, which is usually fed off, and the residues ploughed in during November, resulting in a late fallow for the succeeding barley crop, accounts for the much higher average yield of barley in the rotation wheat, rape, barley, peas than in the rotation wheat, barley peas.

TABLE 16.—AVERAGE RETURNS OF OATS AND BARLEY GROWN IN ROTATION WITH WHEAT FOR THE SEASONS 1918-29.

	Wheat.	Oats.		Barley.	
		Average Twelve Years.	Yield 1929.	Average Twelve Years.	Yield 1929.
Wheat, barley, peas	24.3	..	..	15.0	20.6*
Wheat, oats, peas	24.1	3.6	19.2	..	..
Wheat, oats, bare fallow	34.1	8.3	21.3	..	..
Wheat, oats, pasture, bare fallow	33.5	9.2	21.9	..	..
Wheat, rape, barley, peas	26.6	..	..	19.4	35.8

* 10 years average.

CENSUS STUDIES ON THE GROWTH OF WHEAT CROPS.

During the past four years, at Longerenong and in three other districts—Werribee, Rutherglen, and Carwarp—opportunity has been taken of making actual observations of the growth of various varieties of wheat in the experimental plots. The purpose, in the first place, was to obtain accurate knowledge of the behaviour of the most important varieties in the various districts in the State, as to their capacity for spring stooling, for head production, for grain size and yield; and thus to determine the high-yielding attributes of these wheats in so far as external characters are concerned. The information so derived will be handed on to the wheat-breeders, who in their turn can then produce and select varieties which excel in those characteristics which are particularly favorable for the district where the wheats will be sown.

Latterly the method has been extended to other types of trial, and during the past year, 1929, was used to determine the differences between summer and winter fallow at Longerenong. The observations are being continued this year.

The varieties Federation, Free Gallipoli, Nizam, and Wannon have been subjected to this examination, which consisted of the counting of scattered samples of crop at three stages in the life history of the plants.

As a result of the three years' study, which have been under dry conditions of climate, the following conclusions have been arrived at:—

Population.—With a rate of seeding of approximately 75 lb. per acre, about ten seeds are sown per foot of drill row. Since good germination conditions generally prevail in the Wimmera, about 85 to 90 per cent. of this seed produces plants, and normally in this district 75 per cent. of the seed sown gives plants that reach maturity.

Stooling and Head Production.—It has been found that Federation and its selection Wannon tend to have a very vigorous spring growth, while the

other two varieties, Free Gallipoli and Nizam, tend to produce a lower number of stools per plant. All the varieties produced much greater growth in these rich black soils than was found at the other stations. With regard to head production, the dry seasons have favoured those varieties that have been more sparse in their leafy growth. Consequently it has been found that Nizam, and to a less degree Free Gallipoli, have produced more heads per foot of crop than Federation. Wannon with its very dense growth suffered most severely.

AVERAGE STOOLING AND HEAD PRODUCTION FOR 1928 AND 1929.

Variety.	Average Stools per Foot.	Average Heads per Foot.	Per cent. Survival of Stools to Heads.
Nizam	43.0	17.6	40.9
Free Gallipoli	41.3	14.6	35.4
Federation	49.4	16.0	32.4
Wannon	55.9	13.1	23.5

The high figure for percentage survival of spring growth to head production for Nizam and Free Gallipoli gives a good indication of drought resistance.

Ear Production.—The results from the studies of sizes of head indicate that Free Gallipoli has produced the biggest average sized head, due chiefly to its large grain and the ability to produce the largest number of grains across the spikelet.

AVERAGE SIZE OF HEAD PRODUCED DURING 1928 AND 1929.

Variety.	No. of Grains per Head.	No. of Grains per Spikelet.	Weight of Grain.	Weight of Head.
			grams per 1,000 grains.	grams per Head.
Nizam	13.9	1.19	33.2	.46
Free Gallipoli	15.1	1.68	34.0	.50
Federation	13.9	1.21	30.7	.41
Wannon	15.2	1.25	30.4	.48

Yield.—The type of season during the past two years has favoured those varieties which have been conservative in their stooling, and therefore have not had the bulk of crop to carry through to harvest. Particularly during the past year the season demanded as well an early maturing variety, and thus we find that of the four varieties studied, Nizam has yielded the best.

AVERAGE YIELD FACTORS, 1928, 1929.

Variety.	Ears per Foot.	Weight of Ear.	Yield.
		grams.	Bushels per Acre.
Nizam	17.6	.46	21.8
Free Gallipoli	14.6	.50	20.2
Federation	16.0	.41	18.6
Wannon	13.1	.48	17.9

The studies will be continued in order that the behaviour of the type varieties may be studied during seasons of better rainfall.

TABLE 17.—BULK FIELD RESULTS.

The following table summarizes the areas harvested, time of sowing, rate of seeding, rate of manuring, and average yield per acre on the Longerenong College Farm for years 1913–29.

	1913.	1914.	1915.	1916.	1917.	1918.
Area harvested	265 Ac.	100 Ac.	274 Ac.	361 Ac.	305 Ac.	342 Ac.
Time of sowing	30 April to 22 June	14 May to 30 June	20 May to 31 July	2 June to 18 Aug.	23 May to 30 June	5 May to 17 July
Sowing seed per acre ..	60 to 70 lb.	60 to 63 lb.	50, 60, & 90 lb.	75 to 90 lb.	60 to 90 lb.	74 to 84 lb.
Super. per acre	56 lb.	70 lb.	70 lb.	112 lb.	100 lb.	84 to 112 lb.
Average yield per acre ..	26 bus.	6 bus.	28 bus.	34.1 bus.	39.5 bus.	36.2 bus.
Rainfall—Total	19 in.	12½ in.	16½ in.	21 in.	16½ in.	14½ in.
Rainfall—1st June to 30th November	10½ in.	4½ in.	13 in.	17½ in.	10½ in.	8 in.

	1919.	1920.	1921.	1922.	1923.	1924.
Area harvested	242 Ac.	266 Ac.	320 Ac.	383 Ac.	371 Ac.	349 Ac.
Time of sowing	26 May to 17 July	20 May to 14 July	4 June to 8 July	10 June to 20 July	11 June to 10 July	14 June to 19 July
Sowing seed per acre ..	75 to 85 lb.	80 to 90 lb.	85 to 90 lb.	85 to 90 lb.	85 to 90 lb.	85 to 90 lb.
Super. per acre	110 to 112 lb.	90 to 112 lb.	112 lb.	112 lb.	140 lb.	132 to 180 lb.
Average yield per acre ..	27.1 bus.	38 bus.	42 bus.	30 bus.	47.4 bus.	41.1 bus.
Rainfall—Total	11½ in.	15 in.	17 in.	16½ in.	15½ in.	18 in.
Rainfall—1st June to 30th November	4½ in.	11 in.	8½ in.	9½ in.	11 in.	12½ in.

	1925.	1926.	1927.	1928.	1929.
Area harvested	444 Ac.	420 Ac.	339 Ac.	441 Ac.	479 Ac.
Time of sowing	24 June to 10 July	3 June to 2 July	21 June to 12 July	14 June to 5 July	11 June to 5 July
Sowing seed per acre ..	85 to 90 lb.	84 lb.	84 lb.	80 to 84 lb.	80 to 84 lb.
Super. per acre	150 lb.	140 lb.	150 lb.	150 lb.	150 lb.
Average yield per acre ..	36.1 bus.	39.6 bus.	24.3 bus.	17.6 bus.	17.4 bus.
Rainfall—Total	11½ in.	15 in.	10.18 in.	16.1 in.	13.7 in.
Rainfall—1st June to 30th November	6½ in.	8½ in.	6.4 in.	7.7 in.	5.8 in.

SULPHURING APRICOTS.

Revised Procedure recommended by Committee convened to draw up a Standard Method.

Last year a committee, consisting of Messrs. Geo. Quinn, Chief Horticultural Officer, South Australia; C. G. Savage, Director of Fruit Culture, New South Wales; A. V. Lyon, Officer in Charge, Research Station, Merbein; and W. R. Jewell, Research Chemist, Department of Agriculture, Victoria, was convened by the Council for Scientific and Industrial Research to consider the question of sulphuring dried fruits, and it issued a recommended procedure which, in the case of apricots, might reasonably be expected to give a satisfactory product without an excess of sulphur dioxide. The sulphuring of peaches and pears, in the opinion of the committee, did not offer any serious difficulties.

As a result of experimental work conducted by the members of the committee last season, it is now in a position to recommend a somewhat modified procedure which is likely to give more satisfactory results. This procedure is outlined below.

In view of the fact that quantities of apricots were again over-sulphured last season, it would appear that some growers have still failed to realize the care that is essential in sulphuring, and it is apparent that growers must take more care if the resultant product is to comply with the regulations in force here and in England regarding the amount of sulphur dioxide permitted in dried fruit. In his own interests, therefore, every grower producing dried apricots is strongly recommended to adopt the procedure outlined below, when he should experience little difficulty in keeping the sulphur dioxide content below 14 grains per pound, and, at the same time, produce a marketable product.

Recommended Procedure.

(a) *Maturity*.—It is essential that all fruits be picked "eating ripe," and that, when cutting, all firm or over-ripe fruit should be put to one side, and either discarded or sulphured separately, so that all the fruit in one chamber may be of uniform maturity, and, therefore, yield a uniformly sulphured product. It is recognized that firm fruit absorbs sulphur less readily than ripe, and generally gives an unsatisfactory product.

(b) *Type of Chamber*.—It is recommended that an air-tight chamber be used, the covering of which should be of some light material, e.g., "malthoid." In the case of movable hoods, precautions should be taken to prevent ingress of air at the base of the hood, as, for example, by using compacted moist earth around the bottom.

A number of small air-tight chambers is recommended in preference to one large one, so that fruit shall not be held for any length of time after cutting and before sulphuring. For example, when using 6-ft. x 3-ft. trays, the size of the chamber should be sufficient to accommodate a stand of about fifteen trays with a clearance of about 6 inches between the trays and the sides and top of the chamber. Trays should be "staggered" 6 inches when stacking.

A vent hole, 1 inch in diameter, should be provided in the roof of the chamber close to the wall farthest from the sulphur fire when

one fire is used, or in the centre of the roof where a fire is used at each end of the chamber.

A movable slide, preferably of glass, is a desirable adjunct in order to view the conditions inside the chamber and to test the condition of samples of the fruit.

(c) *Quantity of Sulphur*.—From 6 to 8 lb. of sulphur per ton of fresh-cut fruit should prove ample, and it is essential that the sulphur be dry in order to burn readily. The sulphur pit should preferably be located just outside at one or both ends of the chamber, with a free entrance into the chamber and a small inlet vent to the sulphur pit.

The sulphur should burn steadily during the time the fruit is in the chamber, and slight fumes should be apparent issuing from the vent hole. Should these fumes cease, inspect the sulphur pan. Either relight any unburnt sulphur or add more sulphur if none be left. If the sulphur be all burnt before the expiration of the sulphuring period, it is an indication of excessive draught through the hood. In subsequent sulphurings reduce the draught by reducing the size of the inlet and exit vents and examine the hood for general leakage. It is desirable so to regulate the draught that the requisite quantity of sulphur burn throughout the sulphuring period and be practically burnt out at the expiration of that period.

The weight of fruit in a charge should be ascertained by weighing the quantity of pitted fruit on two or three trays; the average per tray and the total weight per charge can then be obtained. Calculate the amount of sulphur necessary, weigh this, and measure the volume in a container. Thereafter it would be sufficiently accurate to measure the same volume of sulphur each time a similar number of trays is sulphured.

(d) *State of Fruit*.—It is desirable to sulphur as quickly as possible after cutting, preferably within two hours. (Hence the desirability, under (b), of a number of small chambers.)

Fruit should be stacked from the bottom upwards in the order in which it is cut. Freshly-cut fruit absorbs sulphur dioxide more readily than that cut some time prior to sulphuring, and this arrangement of stacking allows the driest fruit to be in contact with the maximum density of warm sulphur fumes, thus tending to uniform sulphuring results.

(e) *Period of Exposure*.—Under average summer day temperatures four to six hours' exposure to the sulphur fumes is considered sufficient to preserve the colour without over-sulphuring; on very hot days four hours should be sufficient. The practice of leaving the fruit in the sulphur chamber overnight is not advocated, as it frequently results in over-sulphuring.

(f) *Characteristics of Sulphured Fruit*.—The filling of the cups with juice is not necessarily a reliable indication of satisfactory sulphuring, as fruit in this condition may frequently be over-sulphured.

Correctly sulphured fruit is usually characterized by an easily detachable skin with distinct exudation of juice into the cup and a general evenness of colour of the cut surface.

(g) *Drying*.—The sulphur dioxide content may be reduced by allowing trays to stand in the shade for one or two days after sulphuring before exposure to the sun, and this procedure is recommended in all cases where there is any suspicion of over-sulphuring.

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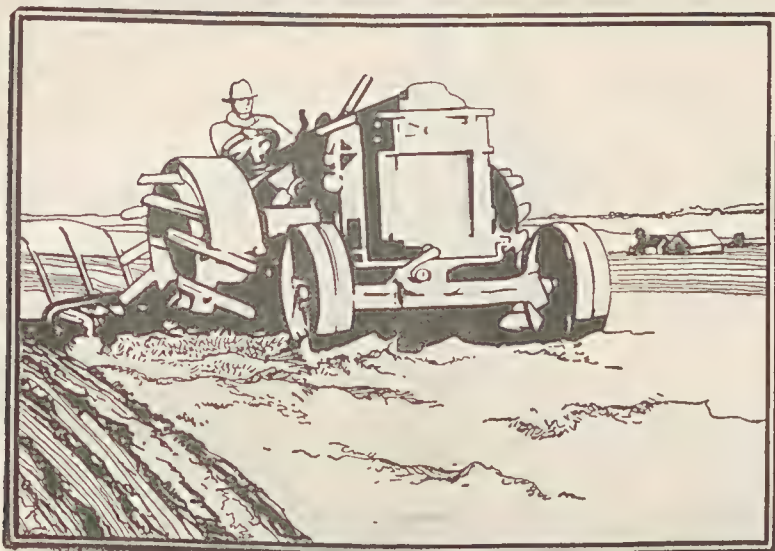


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